

## NEW SPECIES OF SOFT CORALS (COELENTERATA:OCTOCORALLIA) FROM THE LACCADIVE ARCHIPELAGO.

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### ABSTRACT

Six new species of soft corals from the family Alcyoniidae are described: *Sinularia jasninae* sp. nov., *S. parulekari* sp. nov., *S. kavarrattiensis* sp. nov., *S. gaveshaniae* sp. nov., *Lobophytum tecticum* sp. nov. and *Sarcophyton spinospiculatum* sp. nov. The material was collected by the Indian National Institute of Oceanography from Kavarratti Island in the Laccadive Archipelago.

KEYWORDS: Coelenterata, Anthozoa, Alcyonacea, Octocorallia, Alcyoniidae, *Lobophytum*, *Sarcophyton*, *Sinularia*, soft corals, new species, taxonomy, Laccadive, India.

### INTRODUCTION

The octocorals treated in this paper were collected in December 1985, by the Biological Oceanography Division of the National Institute of Oceanography, India, during an expedition to Kavarratti Island (Fig. 1) in the Laccadive Archipelago. Four new species of *Sinularia*, one new species of *Lobophytum* and one new species of *Sarcophyton* were found amongst the 18 specimen-lots examined. In addition to the new taxa the following species were present in the collection: *Cladiella kremphi* (Hickson, 1919), *Lobophytum batarum* Moser, 1919, *L. durum* Tixier-Durivault, 1956, *L. strictum* Tixier-Durivault, 1957, *Sarcophyton trocheliophorum* von Marenzeller, 1886, *S. serenei* Tixier-Durivault, 1958, *Sinularia* cf. *gyrosa* (Klunzinger, 1877), *S. muralis* May, 1899, *S. querciformis* (Pratt, 1903), *S. hirta* (Pratt, 1903), and *S. abrupta* Tixier-Durivault, 1970b.

The octocoral fauna from this area of the world, the Maldives, the Laccadives and the south west coast of India, is very poorly known. The only reports of note are those of Hickson (1903, 1905), Pratt (1903) and those on the material collected by the "Investigator" compiled by Thomson and Henderson (1906) and Thomson and Simpson

(1909). The works of Hickson and Pratt involved material solely from the Maldive Archipelago and only two of the species in the present collection were also present amongst their material. These are *Sinularia querciformis* and *S. hirta*. Of the enormous amount of material collected by the "Investigator", very little came from the Laccadive Islands. The report on the material from the littoral area describes only six species from the Laccadives, all gorgonians and mostly taken from 30-50 fathoms. The deep sea report describes only three gorgonians and five sea pens from the area of the Laccadives. Much of this material, however, was collected from the Laccadive Sea, a considerable distance from the reefs and islands, and all but one species was taken from depths greater than 400 fathoms.

All of the new species of *Sinularia* in the present collection belong to Verseveldt's (1980) group 1, having in the surface layers club-shaped sclerites of the *leptocladus*-type. When comparing *Sinularia* species which have *leptocladus*-type clubs, the similarities in surface spiculation of the nominal taxa can be very confusing. Although there can be considerable differences between species in the architecture of the small clubs, for example the dart-like forms of *S. abrupta* Tixier-Durivault, 1970b, and the more complex

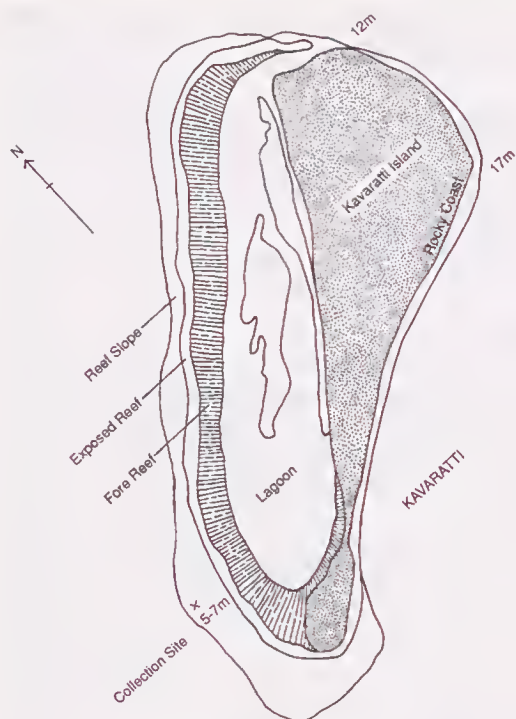


Fig. 1. Kavaratti Island collection site. Scale approximately 1:59,800.

squarer headed forms of *S. densa* (Whitelegge, 1897), it is often very difficult to assess the degree of similarity between text illustrations and the mass of sclerites seen under the microscope. This difficulty is further compounded by the fact that most of this group of species have clubs that lie somewhat midway between the extremes of design. Although, in the final assessment, the shape of the small clubs must not be ignored, it is usually far more productive to put emphasis on the longer clubs and the rod-like or spindle-like sclerites that occur in the surface layers. The differences between species are far more apparent when these sclerites are compared. Unfortunately, many descriptive texts have placed little weight on these characters, although it is quite possible that the method of sampling has had some bearing on this. Many of these sclerites, particularly the elongate non-club-like forms, occur just below the clubs. A shallow slice of surface material will miss these sclerites, and will often cut the heads off the longer clubs, thus eliminating them from consideration. It is, therefore, advisable to macerate a portion that is excised deep enough to contain the massive coenenchymal spindles, to ensure that sclerites characteristic of the species will not be over-looked.

The abbreviation NTM stands for the Northern Territory Museum.

## SYSTEMATICS

### Family Alcyoniidae Lamouroux Genus *Lobophytum* von Marenzeller

*Lobophytum* von Marenzeller, 1886: 343; Tixier-Durivault 1958: 88-188 [Revision]; Verseveldt 1983: 1-103 [Revision].

**Diagnosis.** Colony form varied. Some flat and encrusting, others taller than wide. Abundant dimorphic polyps, fully retractile and only occurring on the upper part of the colony. Polypary usually sharply delimited from the stalk and rarely without lobes. Lobes finger-like to cockscomb-like, peripherally or centrally located, and sometimes sparingly branched. Sclerites of the surface layer of the polypary and the stalk predominantly small clubs, along with some short rods and spindles. Internally, large spindle or barrel-shaped sclerites occur, usually with warts in whorls. Sclerites of stalk interior commonly shorter and stouter than those within the polypary.

### *Lobophytum tecticum* sp. nov. (Figs 2-12)

**Type material.** HOLOTYPE - NTM C5968; Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E, 5-7m, December 1985, coll. P. Shirwaiker.

**Description.** The holotype, which is split into two pieces, seems to represent most of a single colony (Figs 2, 3). There appears to be a small portion missing from one end. The specimen is of unusual structure, with a thin base, encrusting dead coral, forming a wide spreading stalk which is slightly constricted immediately beneath the folded, overhanging margin of the polypary. The whole colony has the appearance of a plastic structure that has been softened by heat and has sagged and flowed over the coral rock.

The polypary is about 95 mm long by 75 mm at its widest point. The stalk encrusts dead coral, and measured from the lower margins of the base to the tips of the lobes the colony is 30-40 mm tall. The polypary is about 5 mm thick at the margin and overhangs the stalk by up to 25 mm. The folded margin of the polypary is produced into thick lobes which, to varying degrees, extend onto its upper surface. At one end of the colony, where the specimen is split, a peripheral lobe extends



Fig. 2. *Lobophytum tecticum*, holotype. Natural Size.



Fig. 3. *Lobophytum tecticum*, holotype. Natural size.

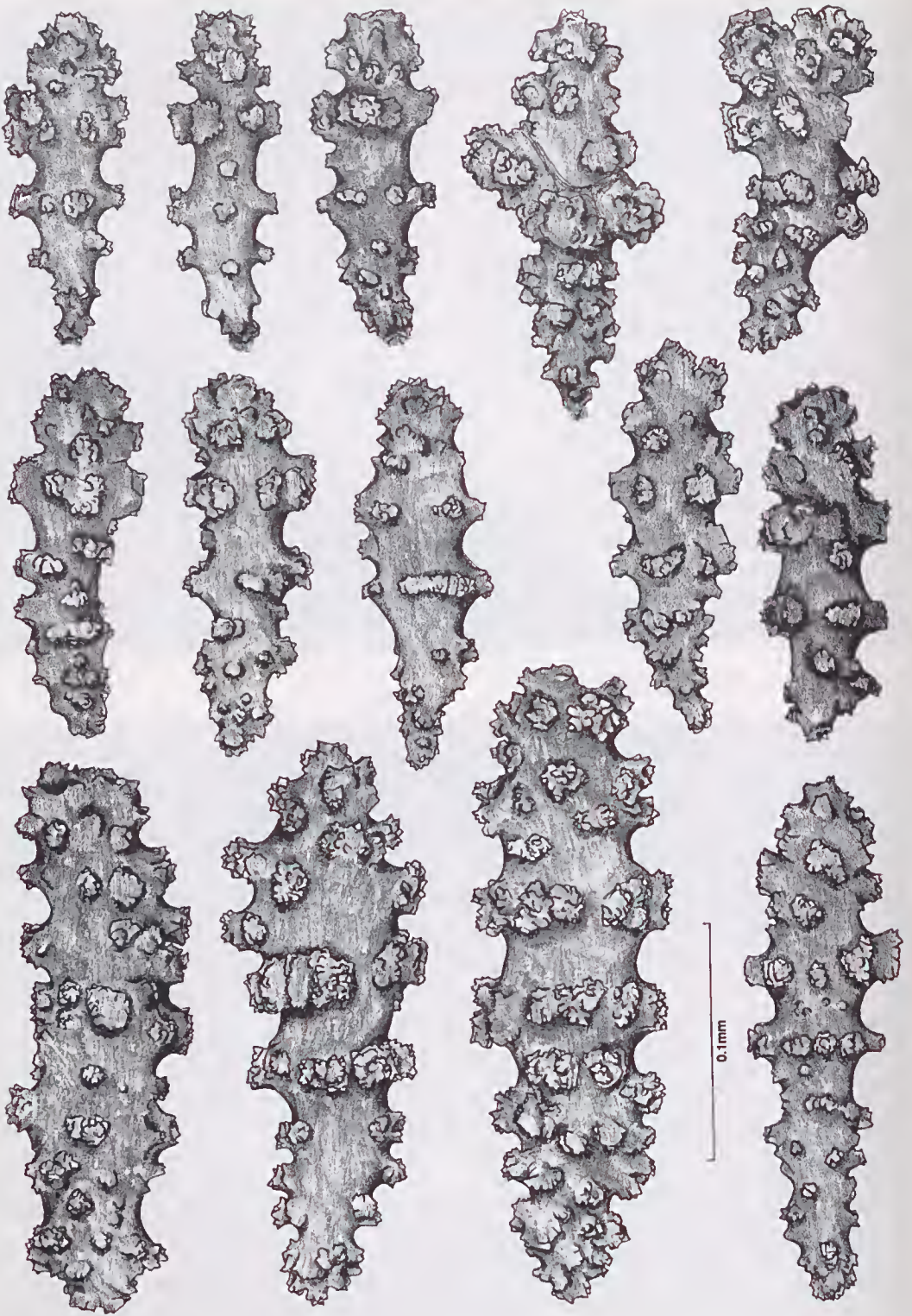


Fig. 4. *Lobophytum tecticum*, holotype, sclerites from the surface of the polypary.

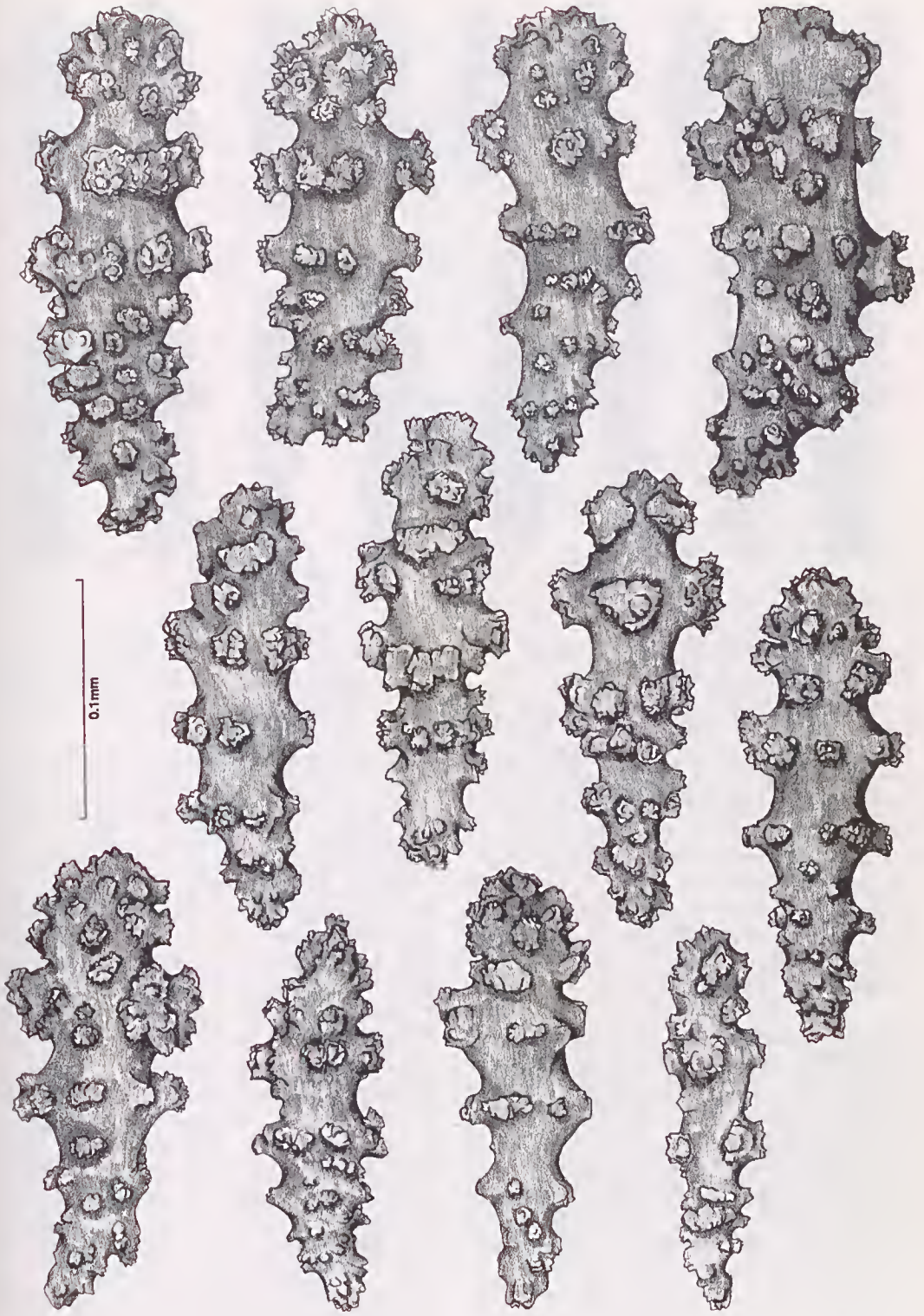


Fig. 5. *Lobophytum tecticum*, holotype, sclerites from the surface of the polypary.

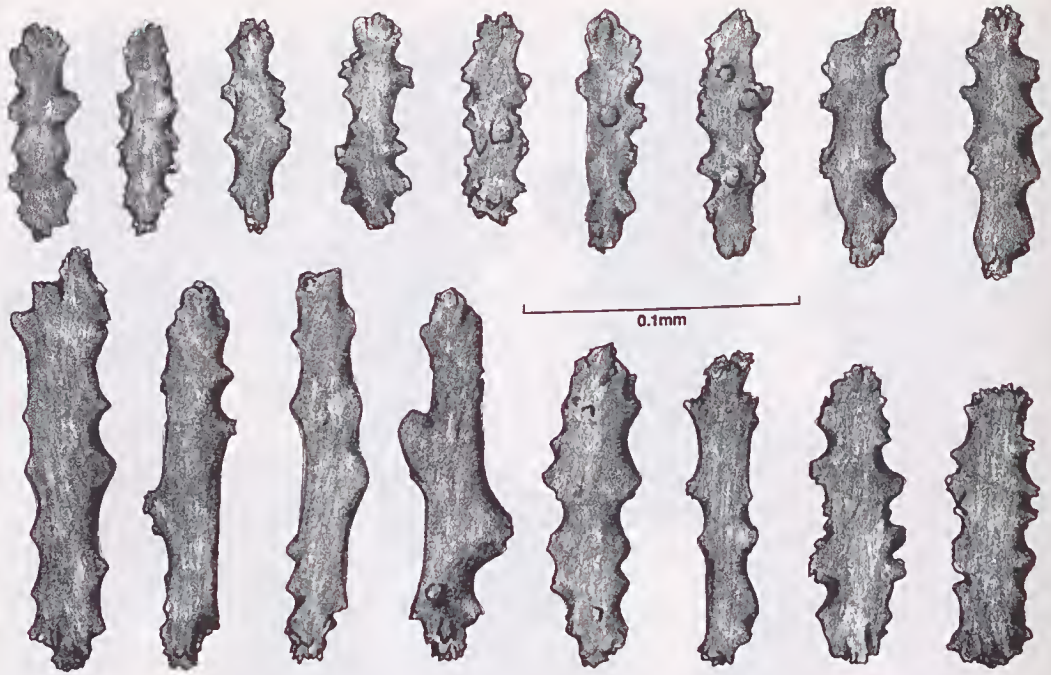


Fig. 6. *Lobophytum tecticum*, holotype, sclerites from the polyps.

cockscomb-like across the most of the polypary over which it is folded down.

The difference in size between the autozooids and the siphonozooids is very small. Although the whole of the surface of the polypary is closely covered with small pits it is only possible in a few isolated areas to distinguish which are attributable to the different zooids. On and near the summits of the lobes there are 1-2 siphonozooids between the autozooids. On the rest of the polypary margin and the sides of the lobes there are 1-3 siphonozooids separating the autozooids. This also appears to be the case over the rest of the polypary.

The colony, which is firm and not very flexible, is uniformly coloured greyish yellow.

The surface of the polypary contains clubs and spindles (Figs 4,5) that cover a wide size range. Apart from the relatively poorly developed club heads, most of the warting on the sclerites is in whorls. Most clubs are 0.12 - 0.24 mm in length. Larger clubs up to 0.34 mm are also found whose shape is intermediate between a club form and the larger spindles (Fig. 7) found both in this layer and the polypary interior. Some of these sclerites may have the warts arranged irregularly, and sometimes the only well defined whorls are two near the middle of the sclerite. A few clubs smaller than 0.12 mm also occur. Most have two whorls

of smooth rounded prominences and several similar terminal prominences in the head and appear to be immature forms. They are rarely smaller than 0.1 mm in length.

The autozooids contain slightly flattened rod-shaped sclerites with low simple rounded prominences or scalloped edges (Fig. 6), 0.08 - 0.16 mm long, occasionally up to 0.20 mm.

The sclerites of the interior of the polypary are varied and must be sampled with care. The interior of the lobes is dominated by large spindles with warts nearly always in whorls. Mostly up to 0.43 mm in length, sometimes reaching 0.45 mm, they are of the same form as those found amongst the clubs in the surface layers (Fig. 7). A few spindles appear somewhat flattened (Fig. 7A), others may be irregularly bent (Fig. 7B), and some spindles have a distinct waist. Mingled with these spindles are a few plumper, usually shorter, sclerites. Some are irregularly shaped, others more cylindrical with two relatively prominent whorls of warts (Figs 8,9). At the base of the lobes the interior sclerites are a more even mixture of long spindles and plump forms. Beneath the surface of the polypary between the lobes, the plump sclerites tend to dominate the sample and many forms intermediate between short spindles and the capstans of the basal coenenehyme are found. Masses of these capstans are encountered

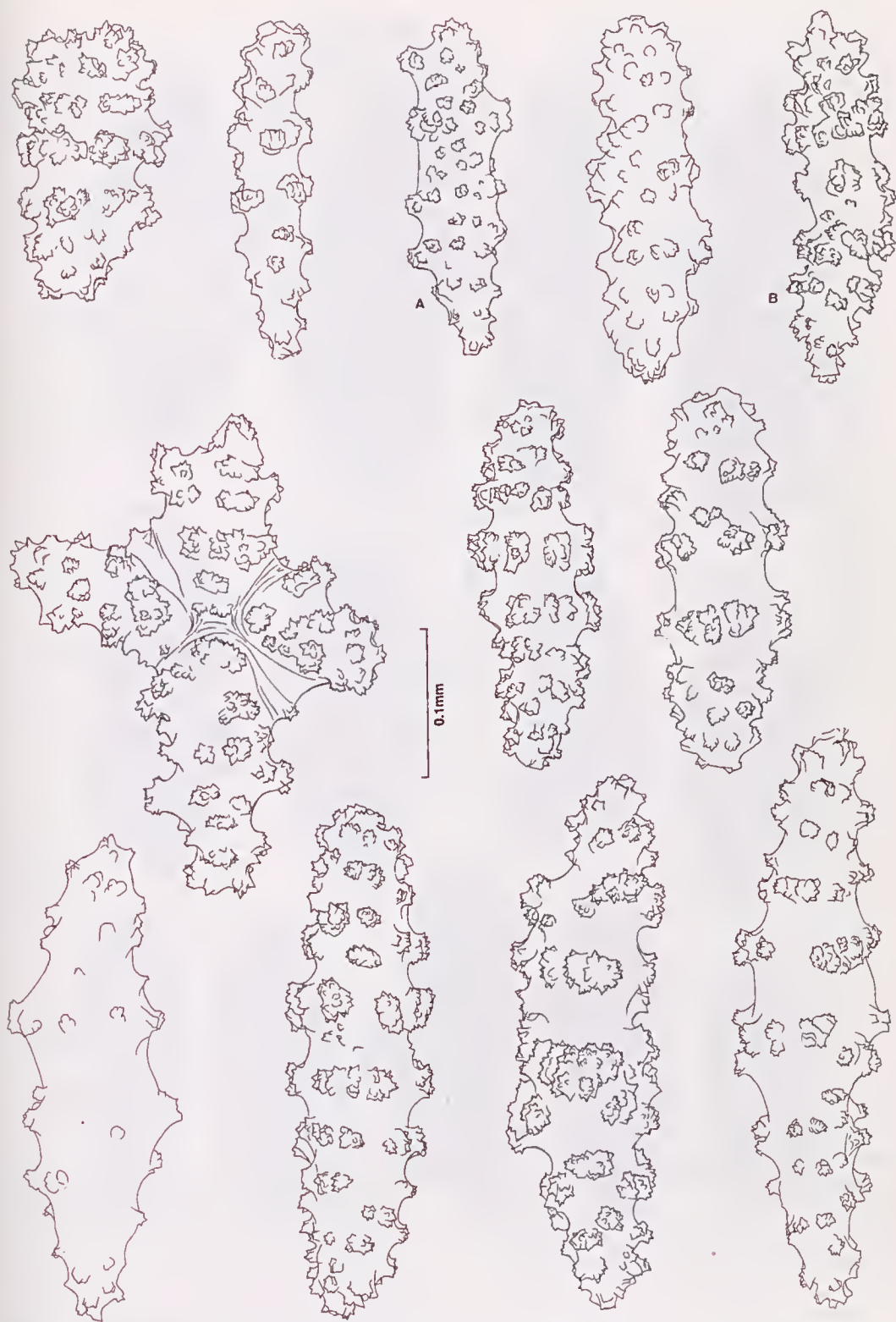


Fig. 7. *Lobophytum tecticum*, holotype, sclerites from the interior of the polypary that also occur in the surface layer.

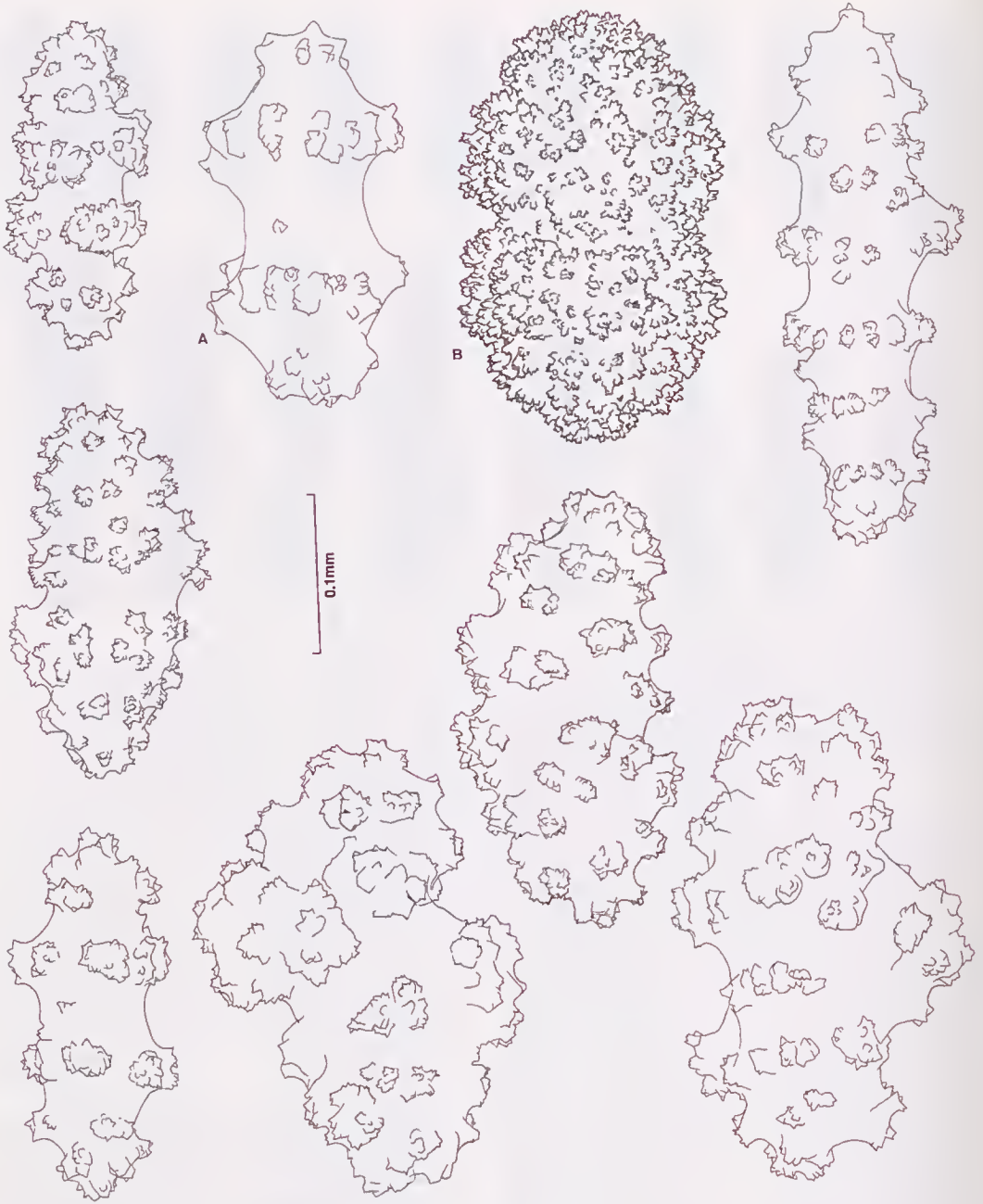


Fig. 8. *Lobophytum tecticum*, holotype, sclerites from the interior of the polypary.

within at least 7 mm of the polypary surface between the lobes, but most of them appear to be immature forms (Figs 8A,9A). A remarkable feature of the polypary interior samples, in which relatively large numbers of plump forms are found, is the occurrence in nearly every sample of one or two sclerites of the form shown in Fig. 8B.

The surface of the basal area of the stalk contains well defined clubs (Figs 10,11), mostly 0.08 - 0.13

mm long with larger forms to 0.18 mm scattered amongst them. In general the heads of the clubs are formed by a whorl of large warts below a terminal warty mass. Another whorl of warts occurs lower on the handle. A few of the smaller clubs have poorly defined heads and are rod-like. Small crosses are not uncommon. A few plump sclerites up to 0.19 mm long, with warts in several whorls, can also be found in this area (Fig. 11A,B).



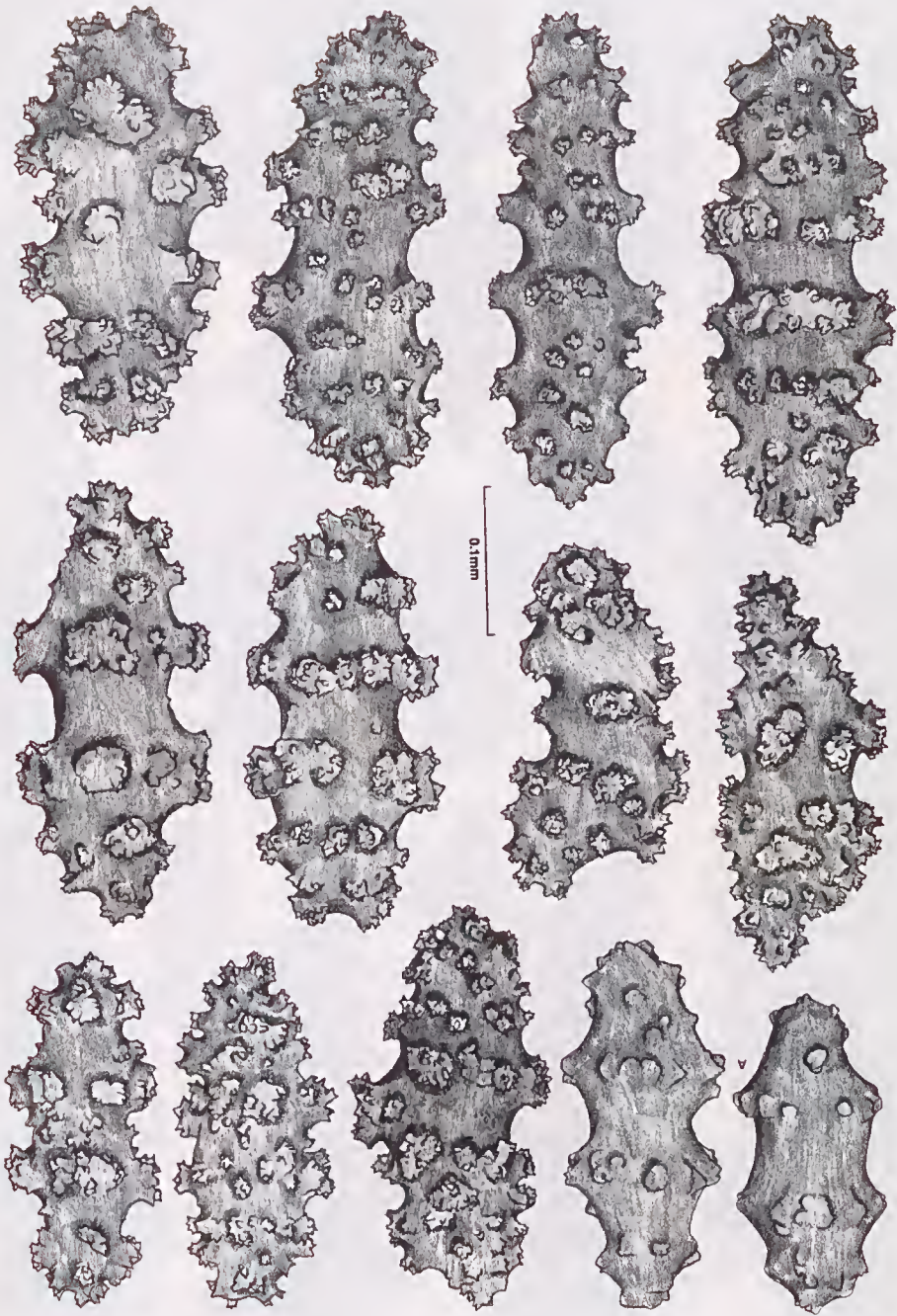


Fig. 9. *Lobophytum tecticum*, holotype, sclerites from the interior of the polypary.

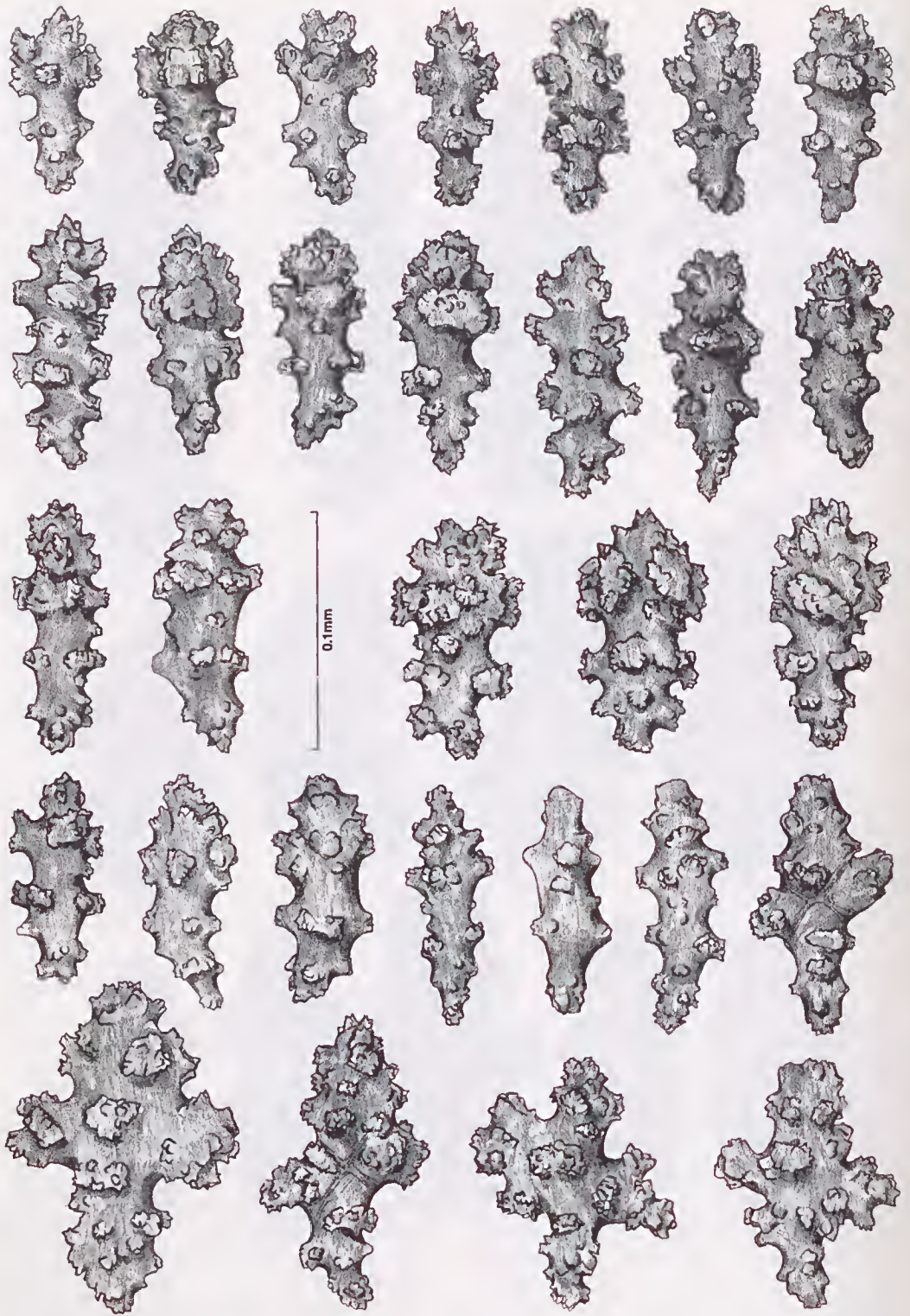


Fig. 10. *Lobophytum tecticum*, holotype, sclerites from the surface of the base.

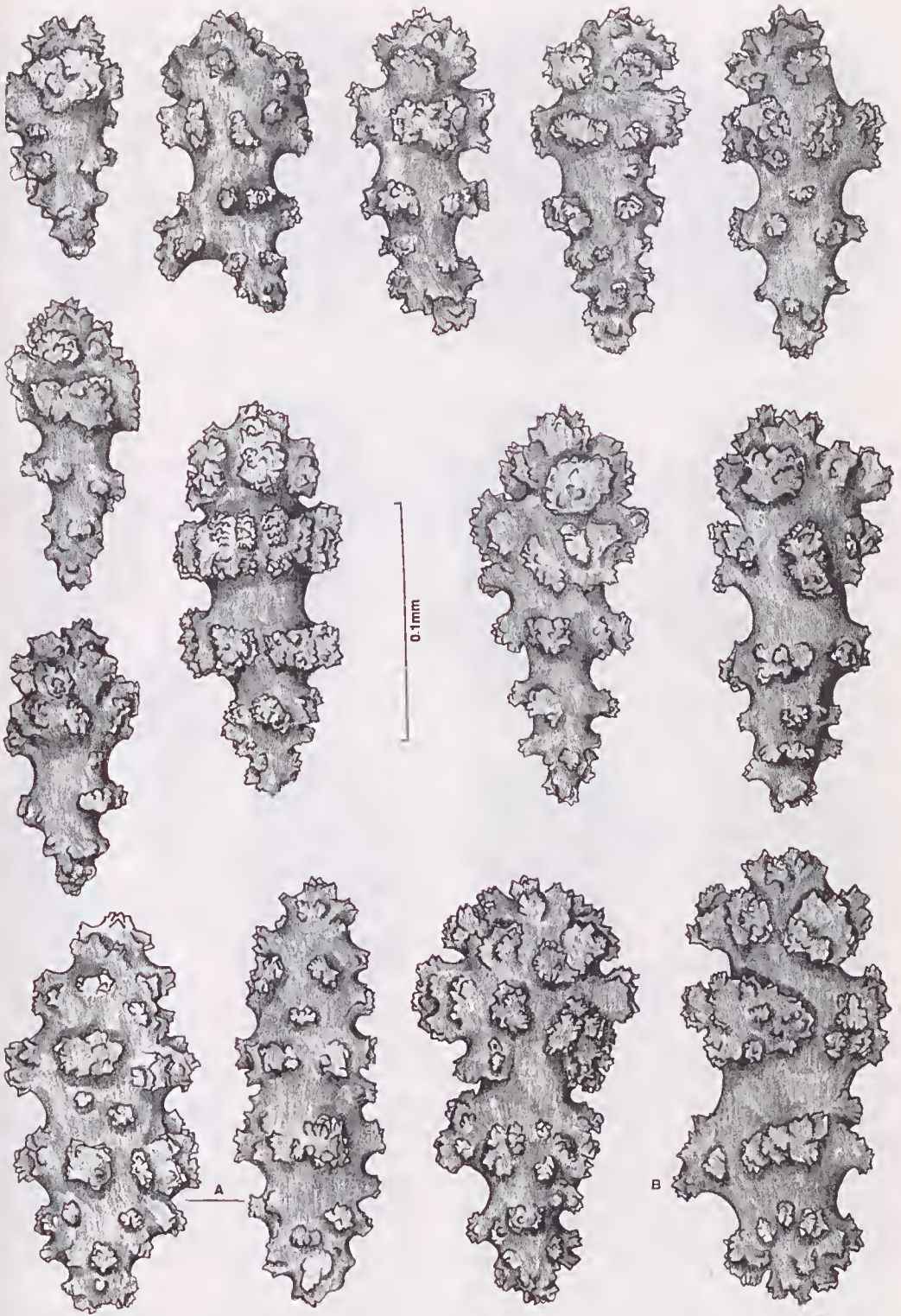


Fig. 11. *Lobophytum tecticum*, holotype, selerites from the surface of the base.

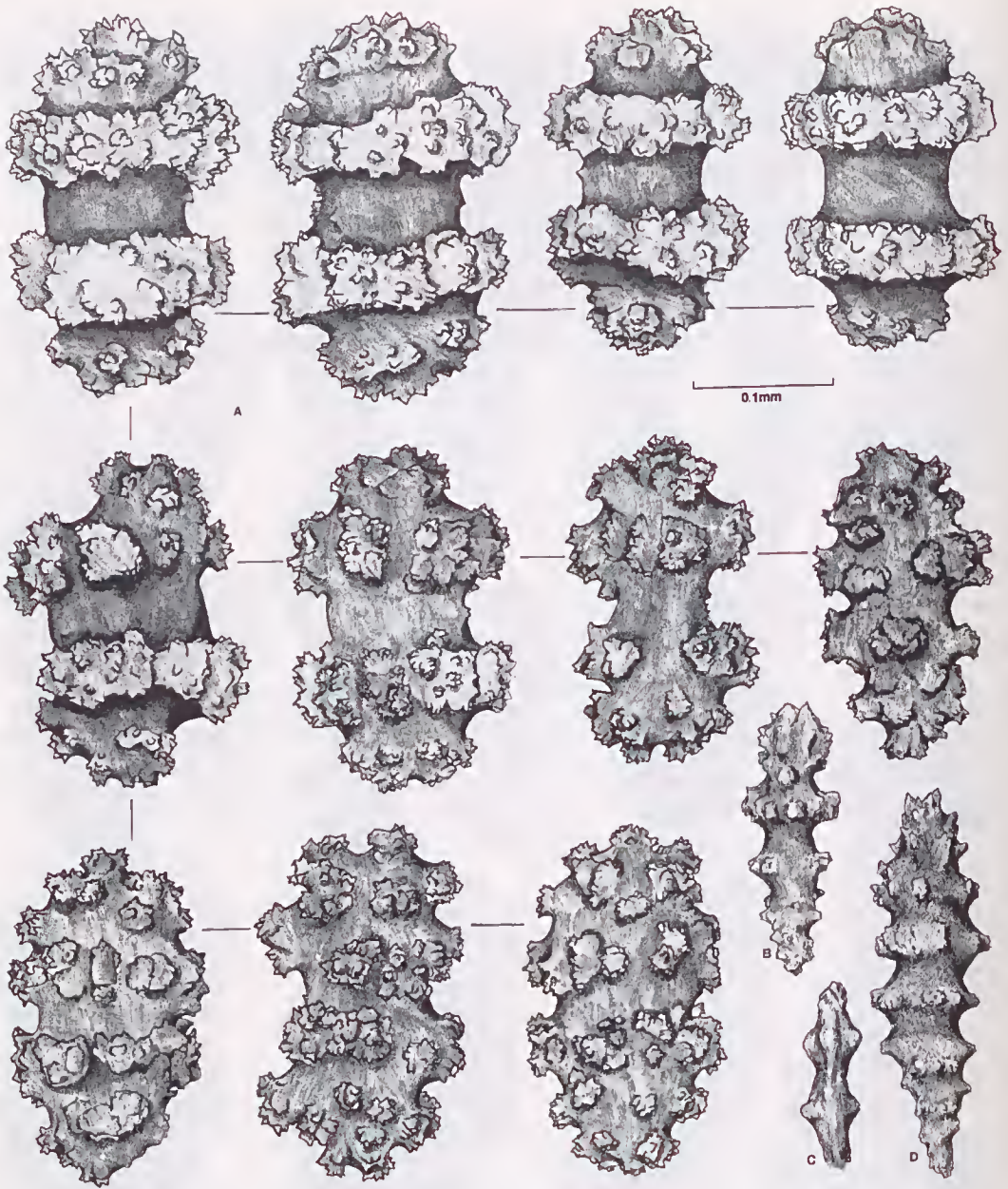


Fig. 12. A, *Lobophytum tecticum*, holotype, sclerites from the interior of the base. B, C, D, *Lobophytum planum*, holotype, sclerite examples.

The basal interior of the stalk is packed with capstans, the majority of which have two well defined whorls of warts (Fig. 12A). A few similarly shaped sclerites with more irregular warting also occur, along with many apparently immature forms with two whorls of conical prominences. The capstans are 0.19-0.27 mm in length with the majority being around 0.24 mm.

**Etymology.** The specific name refers to the colonial form, which is suggestive of something that has partially melted and flowed over the substrate. It is derived from the Greek *tektikos*; pertaining to fluidity.

**Remarks.** A student of *Lobophytum* systematics could be forgiven for being somewhat daunted by the task of identifying a specimen, and reluc-

tant to add a new species to the genus. The differences between species often appears slight and many sclerite forms are shared between nominal taxa. The combination of colony morphology and sclerite architecture described above has not been reported before and, even allowing for variability, the specimen seems sufficiently different from all previously known taxa to warrant erecting a new species. In the establishment of this species, sparsely-lobed taxa such as *L. gazellae* Moser, 1919, *L. schoedei* Moser, 1919, *L. ignotum* Tixier-Durivault, 1956, *L. durum* Tixier-Durivault, 1956, *L. patulum* Tixier-Durivault, 1956, *L. depressum* Tixier-Durivault, 1966, *L. legitimum* Tixier-Durivault, 1970a, *L. planum* Tixier-Durivault, 1970a, *L. variatum* Tixier-Durivault, 1970a, *L. variatum* Tixier-Durivault, 1957, and *L. venustum* Tixier-Durivault, 1957, must all be compared with the new species. There are some similarities with the polypary sclerites of *L. durum* (see Verseveldt 1983) but the sclerites in the rest of the colony are quite different. There would also seem to be similarities with some of the sclerites of *L. planum* as described and illustrated by Verseveldt (1983) in his figure 38. The differences, however, are greater than is apparent. Examination of fragments of the holotype of *L. planum* revealed that the club heads with "small prominences directed upwards" (p. 79) are far thornier than illustrated. The type of club shown here in Fig. 12D is commonly found amongst the lobe surface sclerites. This thorny tendency is also seen in the stalk surface sclerites (Fig. 12B), and noticeable amongst both stalk and disc surface samples are numerous small rods of the type illustrated in Fig. 12C. These various sclerite forms, not shown by Verseveldt, clearly distinguish *L. planum* from the new species.

None of the nominal species, regardless of colony form, have skeletal characters which match those of *L. tecticum*. As a caveat to that it should be added that the new taxa erected by Li (1984) from the South China Sea are not recognisable from his exceedingly brief and sparsely illustrated treatment. However, none of his colonies morphologically resemble *L. tecticum*. Correspondence to China remains unanswered.

### Genus *Sarcophyton* Lesson

*Sarcophyton* Lesson, 1834: 92; Tixier-Durivault 1958: 1-87 [Revision]; Verseveldt 1982: 1-91 [Revision].

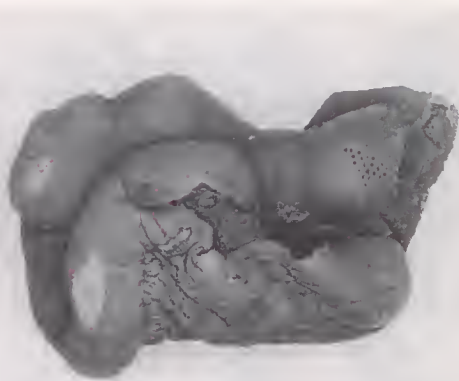


Fig. 13. *Sarcophyton spinospiculatum*, holotype. Natural size.

**Diagnosis.** Colonies with a more-or-less disc-shaped polypary that is usually centrally concave, strongly folded peripherally and sharply delimited from the stalk. In small colonies the margin of the polypary may not be folded. Some colonies may be taller than wide with a long slender stalk. In others the stalk may be very short and comparatively indistinct. The abundant dimorphic polyps are retractile and confined to the folded disc-shaped summit of the colony, the margin of which may considerably overhang the stalk. The sclerites of the surface layer of the polypary and the stalk are predominantly small clubs, along with some short rods and spindles. A few of the clubs of the polypary surface may be quite long. Internally, spindle or barrel-shaped sclerites occur, often with warts in whorls. Sclerites of the stalk interior commonly shorter and stouter than those within the polypary.

### *Sarcophyton spinospiculatum* sp. nov. (Figs 13-19)

**Type Material.** HOLOTYPE - NTM C5965: Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E, 5-7m, December 1985, coll. P. Shirwaiker.

**Description.** The holotype (Fig. 13) is about 60 mm high and 30-40 mm thick. It is a portion torn from the side of a colony of unknown size, and it is tightly curled in on itself. The stalk is present on one side and is about 38 mm high. It is wrinkled and crossed by a number of deep grooves. From base to capitulum, the stalk is entirely covered by fine, parallel, longitudinally arranged ridges and grooves, about 4 ridges per mm.

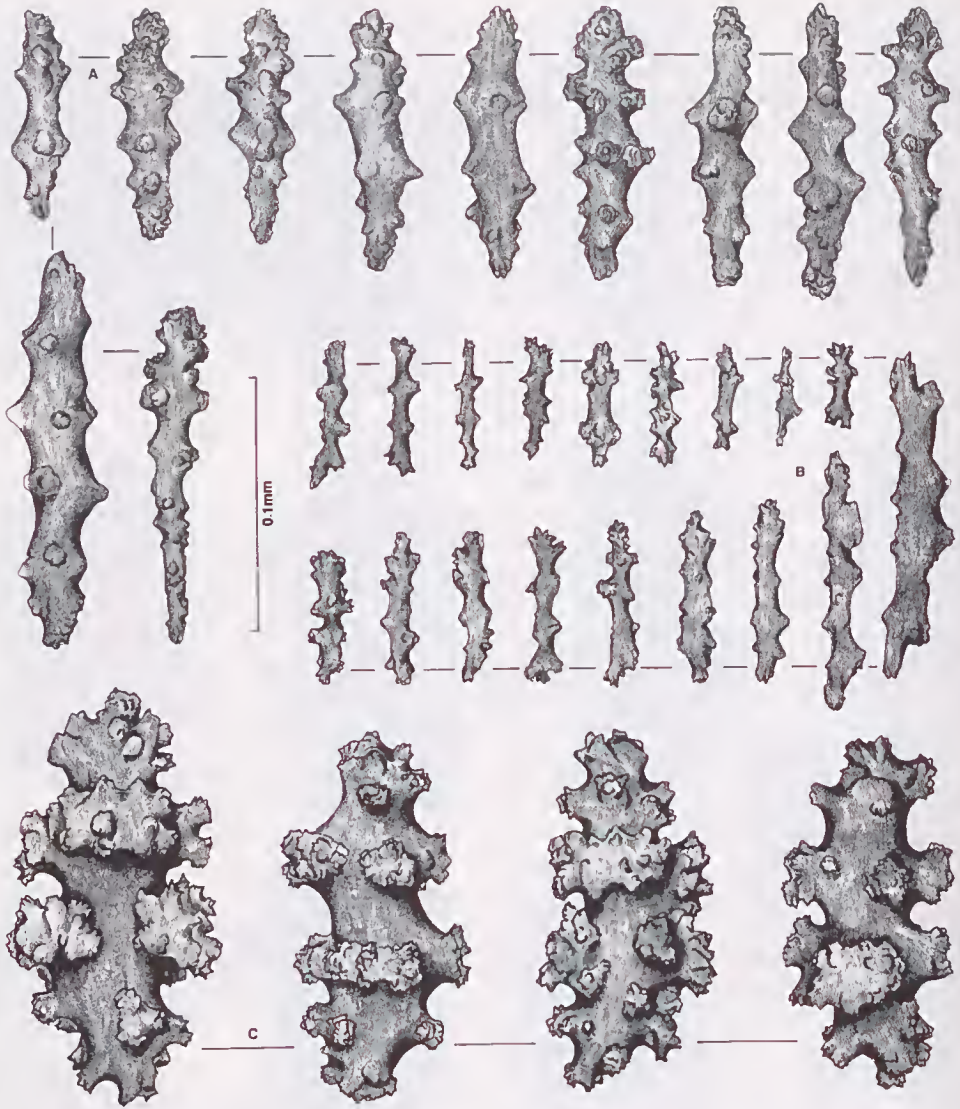


Fig. 14. *Sarcophyton spinospiculatum*, holotype. A, sclerites from the surface of the polypary; B, sclerites from the polyps. C, sclerites from the interior of the base.

The margin of the polypary is about 10 mm thick and only protrudes slightly beyond the stalk. The autozoid and siphonozoid cavities are relatively distinct on the margin, but it is difficult to detect the siphonozooids in the granular surface of the disc without making a tangential section, which reveals 1-2 of them between the autozoids.

The colony is dark brown and is relatively hard.

The surface of the polypary contains clubs and a few spindles (Figs 14A, 15,16). Most of the clubs are about 0.09 - 0.23 mm long, a few are

longer, up to 0.28 mm. The heads of the clubs mostly vary between a blunt dome shape and a narrower rounded point, and are ornamented with very small knobs and ridges. The handles have multiple whorls or irregularly placed, large, more-or-less rounded warts that are covered with small granules and conspicuous longitudinal ridges. Some of the smaller sclerites, possibly immature forms, just have a few simple conical prominences (Fig. 14A). Other clubs have poorly differentiated heads and thick handles and are relatively cylindrical. The largest of the clubs, which



Fig. 15. *Sarcophyton spinospiculatum*, holotype, sclerites from the surface of the polypary.

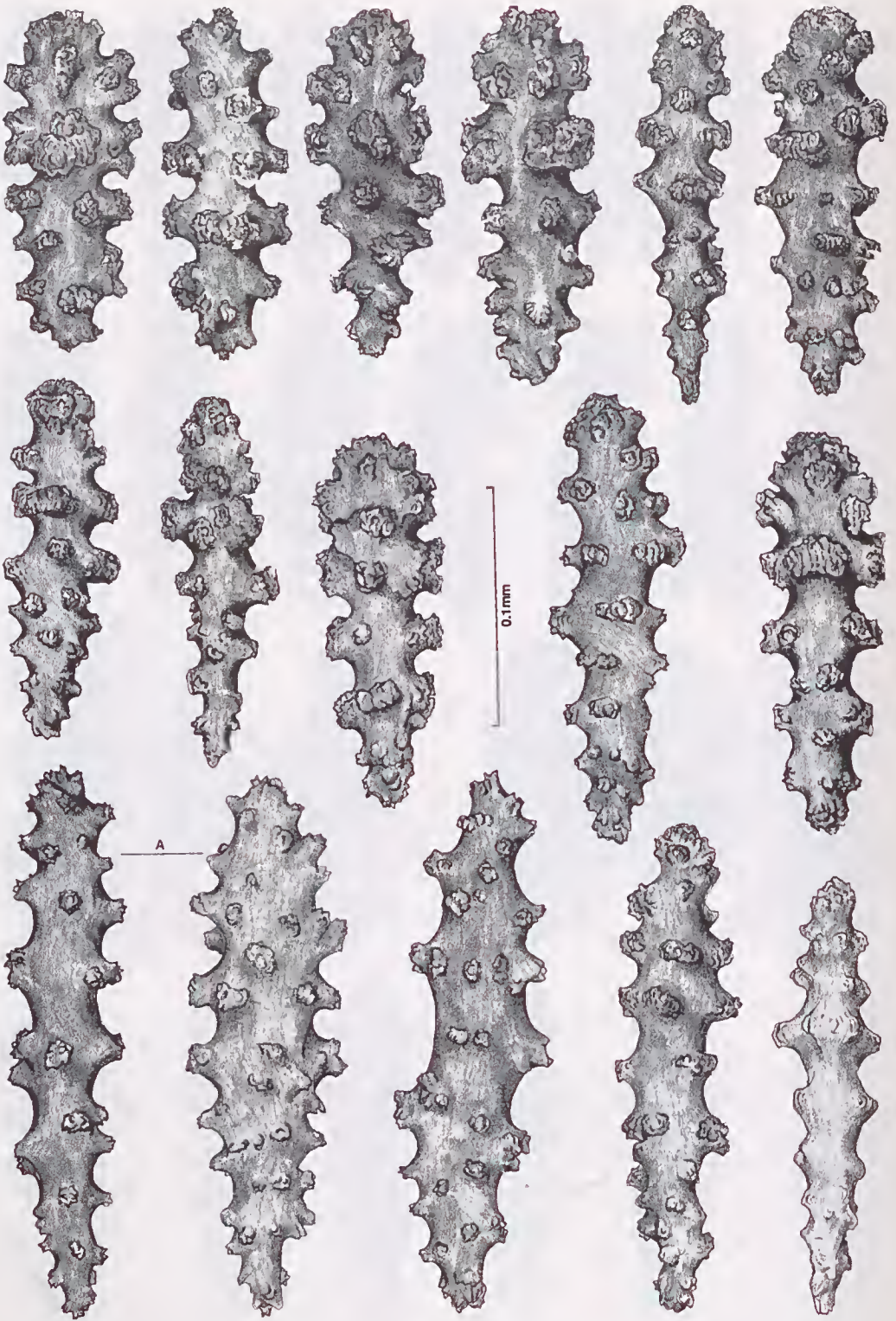


Fig. 16. *Sarcophyton spinosculatum*, holotype, sclerites from the surface of the polypary.



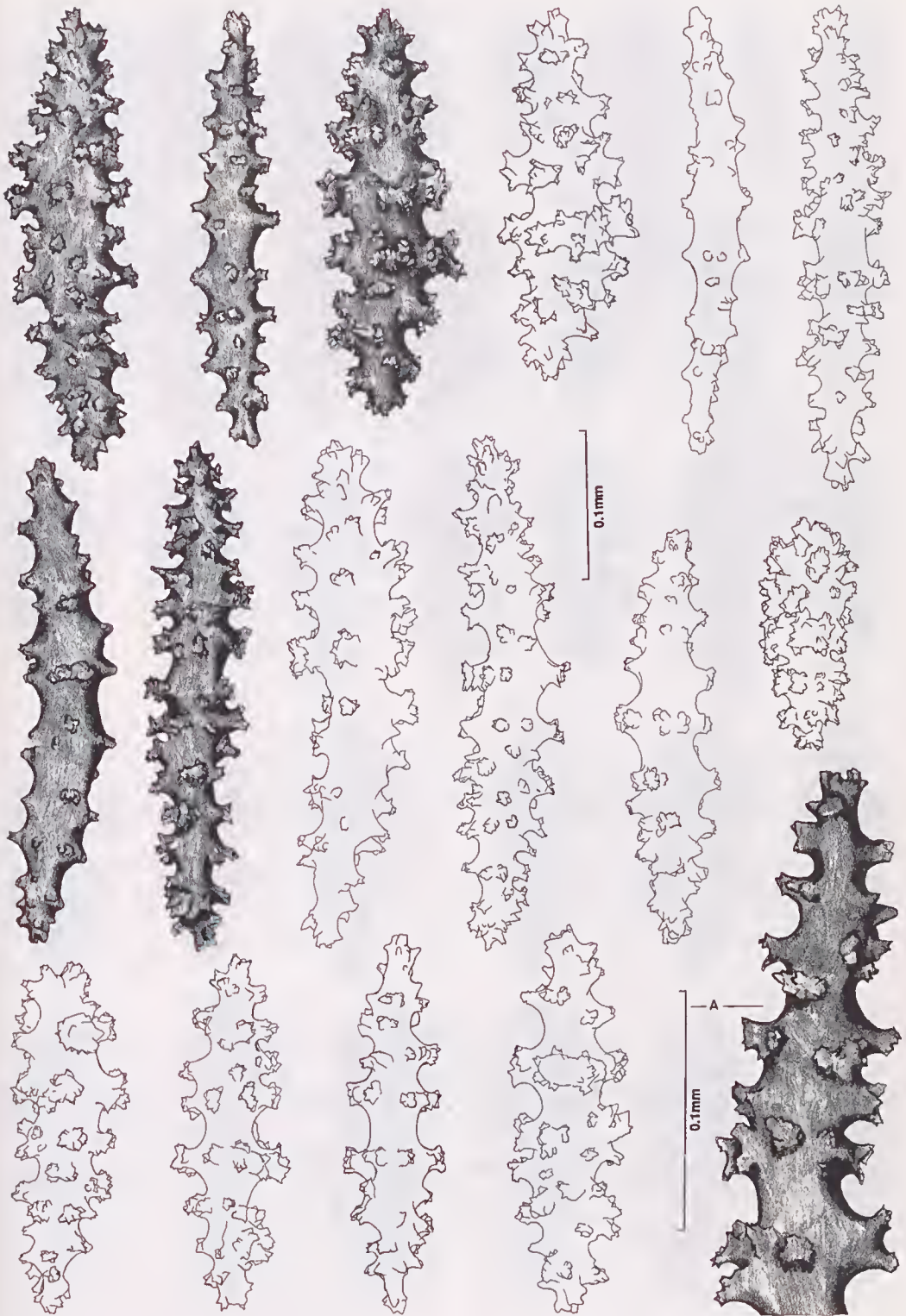


Fig. 17. *Sarcophyton spinospiculatum*, holotype, selerites from the interior of the polypary.

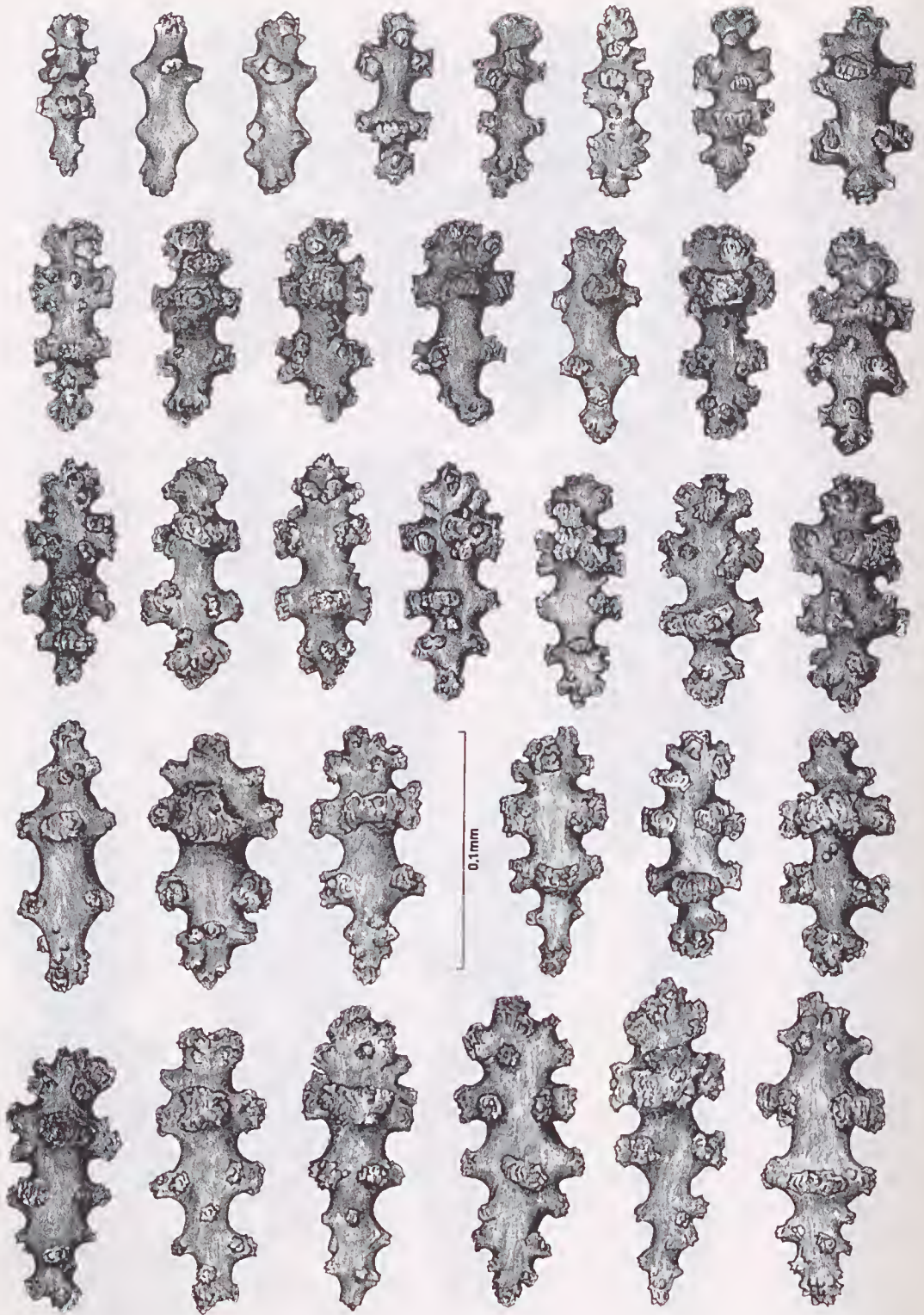


Fig. 18. *Sarcophyton spinospiculatum*, holotype, selerites from the surface of the base.

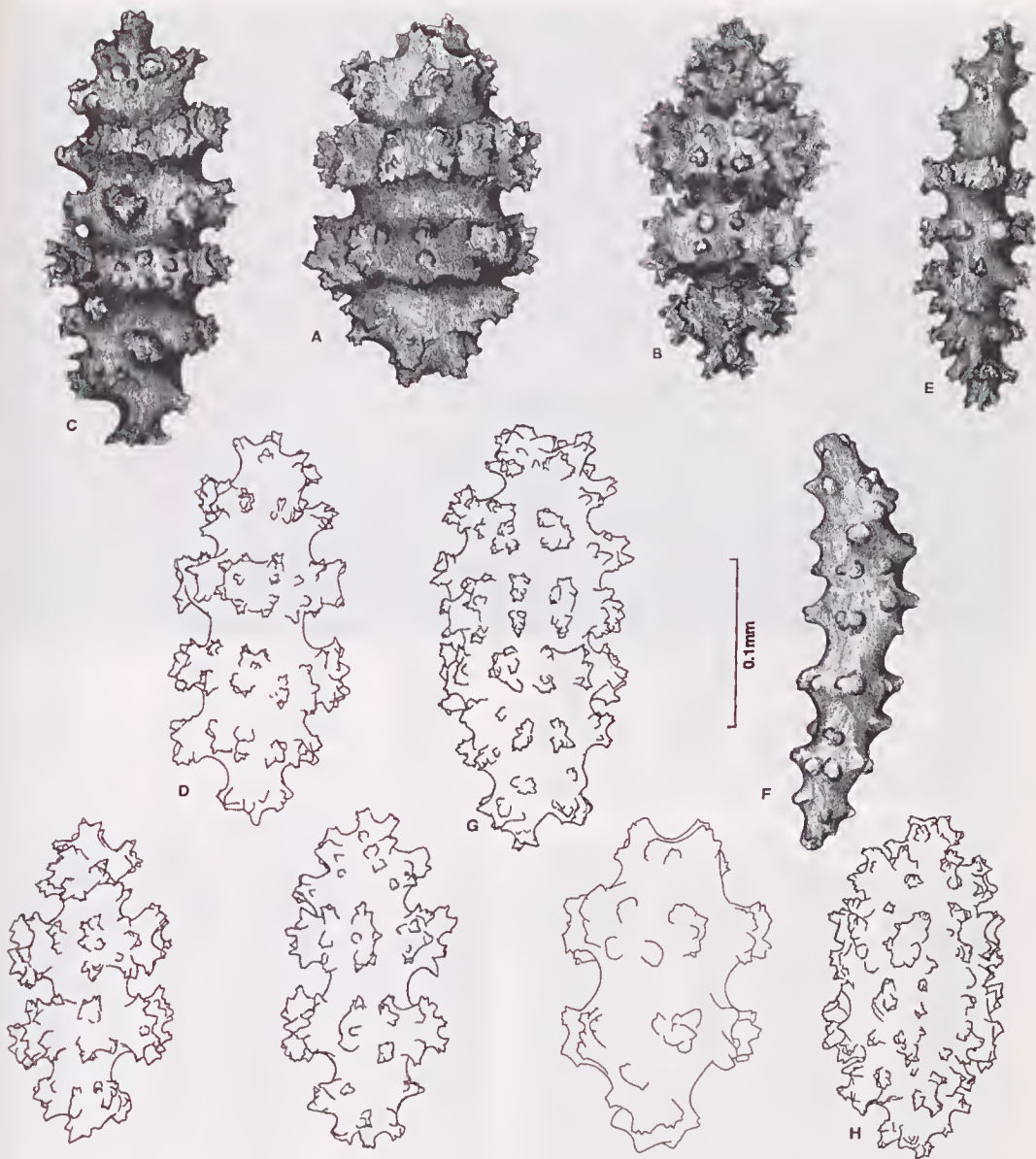


Fig. 19. *Sarcophyton spinosculatum*, holotype, sclerites from the interior of the base.

usually do not have striated warts, are transitional forms to spindles (Fig. 16A).

It is not possible to determine the arrangement of the sclerites in the polyps, which are tightly contracted, dark brown, very tough, and give the appearance that the colony may have dried out at some time. The anthoeodiae contain a few rods and rodlets, about 0.03 - 0.13 mm long (Fig. 14B).

The interior of the polypary contains slender spindles, up to about 0.34 mm long (Fig. 17). They have high thorny warts (Fig.17A) usually

arranged in whorls. The divergent thorns are often reminiscent of the characteristic warts of the disc interior spindles of *Sarcophyton ehrenbergi* von Marenzeller, 1886. A few of the spindles are ornamented with simple cones, others may be slightly eurved and a few are short and somewhat oval shaped. The surface of the stalk contains clubs about 0.08 - 0.14 mm in length (Fig. 18). The warts, with granules and ridges like those of the polypary sclerites, are usually in two whorls. The heads of the clubs are often little bigger than

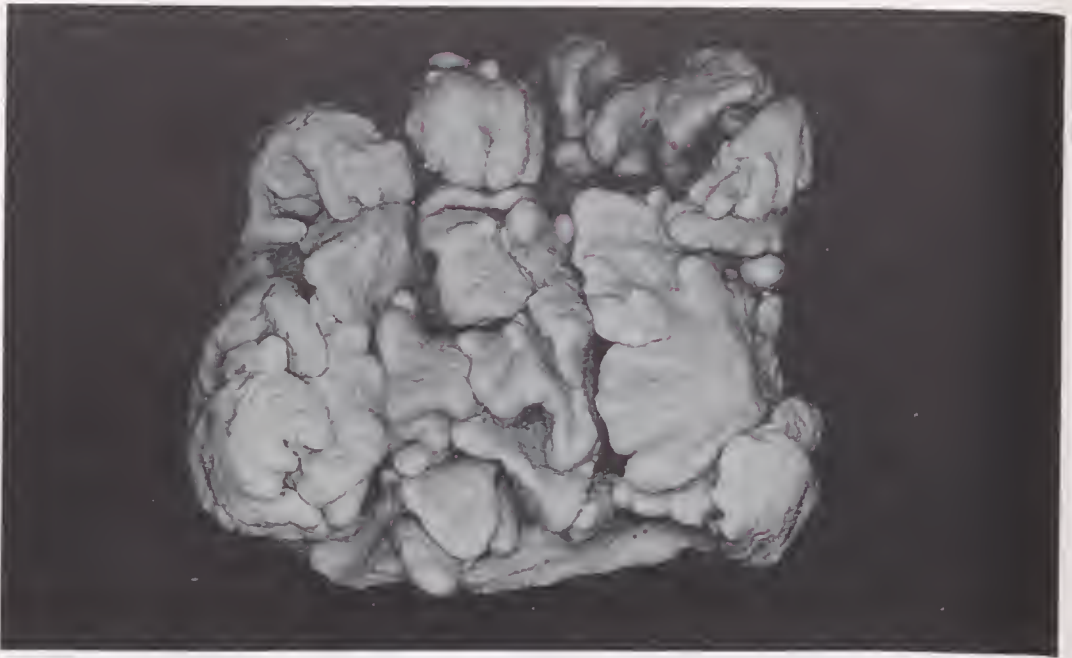


Fig. 20. *Sinularia jasmineae*, holotype. Natural size.

the cluster of warts at the opposite end of the handle, and in some instances the sclerites are quite capstan-like. Some of these are quite small, about 0.07 mm long.

The sclerites of the stalk interior (Figs 14,19) are predominantly oval with two whorls of low warts and about 0.20 - 0.22 mm long (Fig.19A) A minority of them have very thorny warts, and are usually not as plump (Fig.19B). A few longer forms also occur with 4 whorls of warts (Fig.19C,D). They are up to about 0.26 mm long and usually have thorny warts. Occasionally, narrow thorny spindles are encountered. They are similar to those of the interior of the polypary but not as long, about 0.23 mm (Fig. 19E). Rarely, they have simple prominences (Fig. 19F). Some small irregular forms (Fig.14C) and large complexly warted ovals may also occur (Fig. 19G,H).

**Etymology.** The specific name alludes to the spiny nature of the sclerites of the polypary interior.

**Remarks.** The range of variation of colonial form amongst species of *Sarcophyton* is not very great, and there are a number of species with small holotypes that resemble *S. spiuospiculatum*: e.g. *S. boettgeri* Schenk, 1896, and *S. crassocaule* Moser, 1919. None of them, however, have a sclerite component that matches the new species. In some of the specimens attributed by Verveveldt (1982) to *S. crassocaule*, some interior sclerites

and a few clubs of the outmost layer of the stalks are similar to those of *S. spiuospiculatum* (although the warts are not ridged). However, the surface of the discs virtually contain only slender, nearly smooth clubs. Regardless of colony shape, none of the nominal species of *Sarcophyton* resemble the new species, with the exception of *S. pulchellum* Tixier-Durivault, 1957, with which it must be compared. Small points of difference, which may not be significant, are the numerous polyp sclerites in *S. pulchellum* and their size (0.08 - 0.10 mm versus 0.03 - 0.13 mm), and also the many small folds of the holotype of *S. pulchellum* (Verveveldt 1982: fig. 26, pl. 18). The following points are more significant. First, the clubs of the disc surface of *S. pulchellum* have 3 whorls of simple cone-shaped prominences, and narrow heads. Many sclerites of a similar form occur in *S. spiuospiculatum* but there are also many clubs with wide dome-shaped heads, clubs with numerous whorls of warts, and also more cylindrical sclerites. Second, the disc interior sclerites of *S. pulchellum* have small warts and not high thorny ones as found in the new species. Third, the rod-like sclerites with two whorls of warts common in the stalk surface of *S. spiuospiculatum* are not reported for *S. pulchellum*. Last, the conspicuously ridged warts on the surface sclerites of *S. spiuospiculatum* do not occur in *S. pulchellum*.

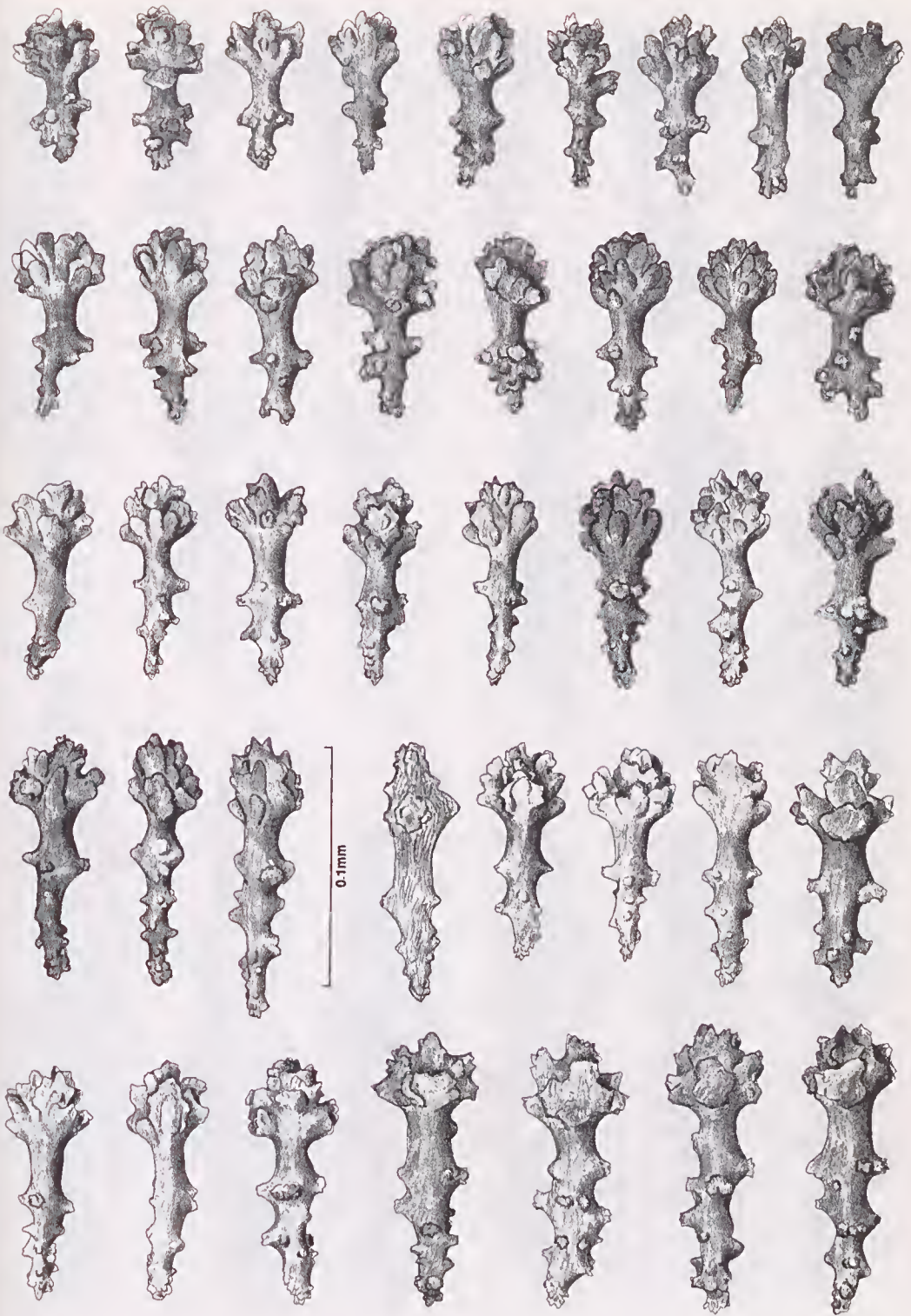


Fig. 21. *Simularia jasminae*, holotype, sclerites of the surface of the lobes.

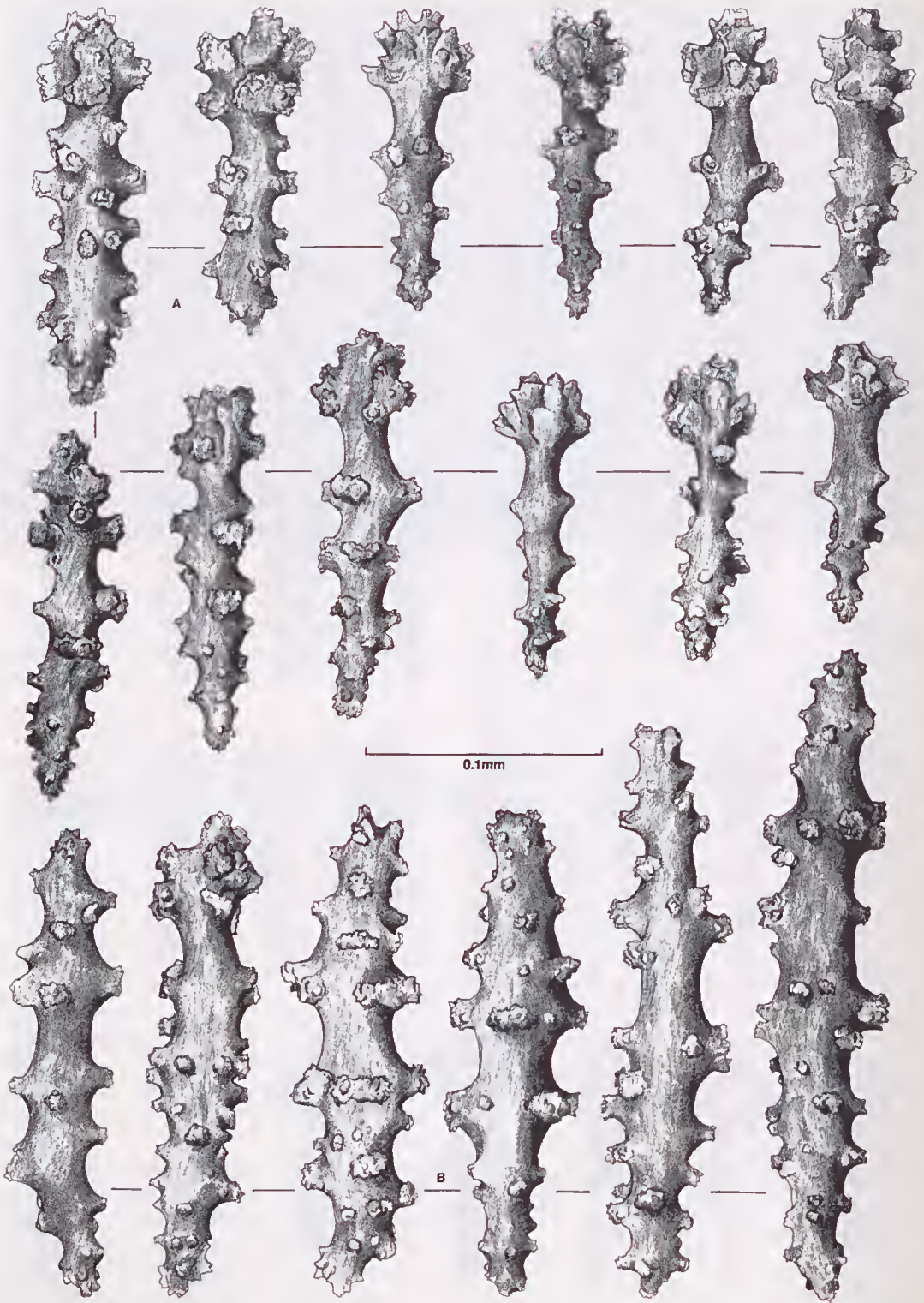


Fig. 22. *Simularia jasmineae*, holotype, sclerites from the surface of the lobes.

Genus *Sinularia* May

*Sinularia* May, 1898: 24; Luttschwager 1914: 1-16 [Revision]; Kolonko 1926: 293-333 [Revision]; Tixier-Durivault 1951: 1-146 [Revision]; Verseveldt 1980: 1-128 [Revision].

**Diagnosis.** Colony form extremely varied. Polyps monomorphic, retractile and restricted to the upper part of the colony. Polypary not sharply delimited from the stalk and rarely without lobes. Lobes knob-like, finger-like, wall-like, simply branched or complexly ramified. Colonies may be taller than wide or form low, large encrusting masses. Sclerites of the surface of the polypary and the stalk are predominantly small elubs, along with short rods and spindles. Larger elubs may also occur. Internal sclerites are large spindles, usually densely covered with complex warts.

*Sinularia jasminae* sp. nov.

(Figs 20-26)

**Type Material.** HOLOTYPE - NTM C5970: Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E, 5-7m, December 1985, coll. P Shirwaiker.

**Description.** Viewed from above the colony is nearly square, being about 83 x 75 mm (Fig. 20). At its thickest part the specimen is 53 mm high. From below, the base of the colony appears convex, with the area of attachment being small and centrally located, about 50 x 25 mm, with embedded sand and shell fragments. The sides of the stalk proceed outward and upwards from the point of attachment and merge gradually into the lobes of the polypary, except on one side where a definite ridge defines the upper limit of the stalk.

The surface of the polypary is crowded with lobes of extremely varied shape. Some are flattened and cockseomb-like, some are digitiform, some are irregularly pyramidal, and most bear one or more small, rounded or digitiform, knob-like lobules.

The polyps are crowded on the lobes. Most are retracted into pits with about 0.75 mm between centres on the upper lobe portions, and 1.20 mm or greater on the lower areas. Numerous zones occur on the sides of the lobes where small numbers of partially expanded polyps occur. The small anthoecodiae, with 8 distinguishable tentacular lobes, are about 0.50 mm in diameter.

The sides of the stalk and the underside of the specimen are brown, the lobes are much paler, approaching a yellowish-grey colour and looking

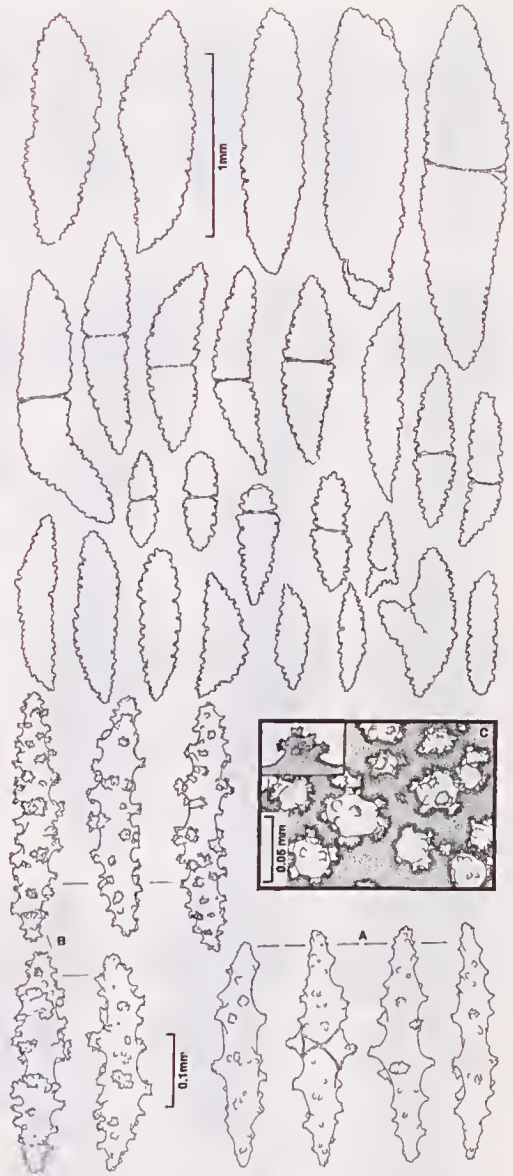


Fig. 23. *Sinularia jasminae*, holotype, sclerites from the interior of the lobes. C, detail of sclerite wartying.

somewhat as though they are made of chamois. The colony is not very firm and is relatively flexible, like soft rubber.

The surface of the lobes contains *leptoclados*-type elubs, mostly 0.06 - 0.10 mm in length, a few slightly larger (Fig. 21). Longer elubs, 0.10 - 0.19 mm, also occur, with thick handles and warty heads and are mostly not of the *leptoclados*-type (Fig. 22A). Below the elubs are slender warty spindles, often with a waist, up to 0.24 mm or

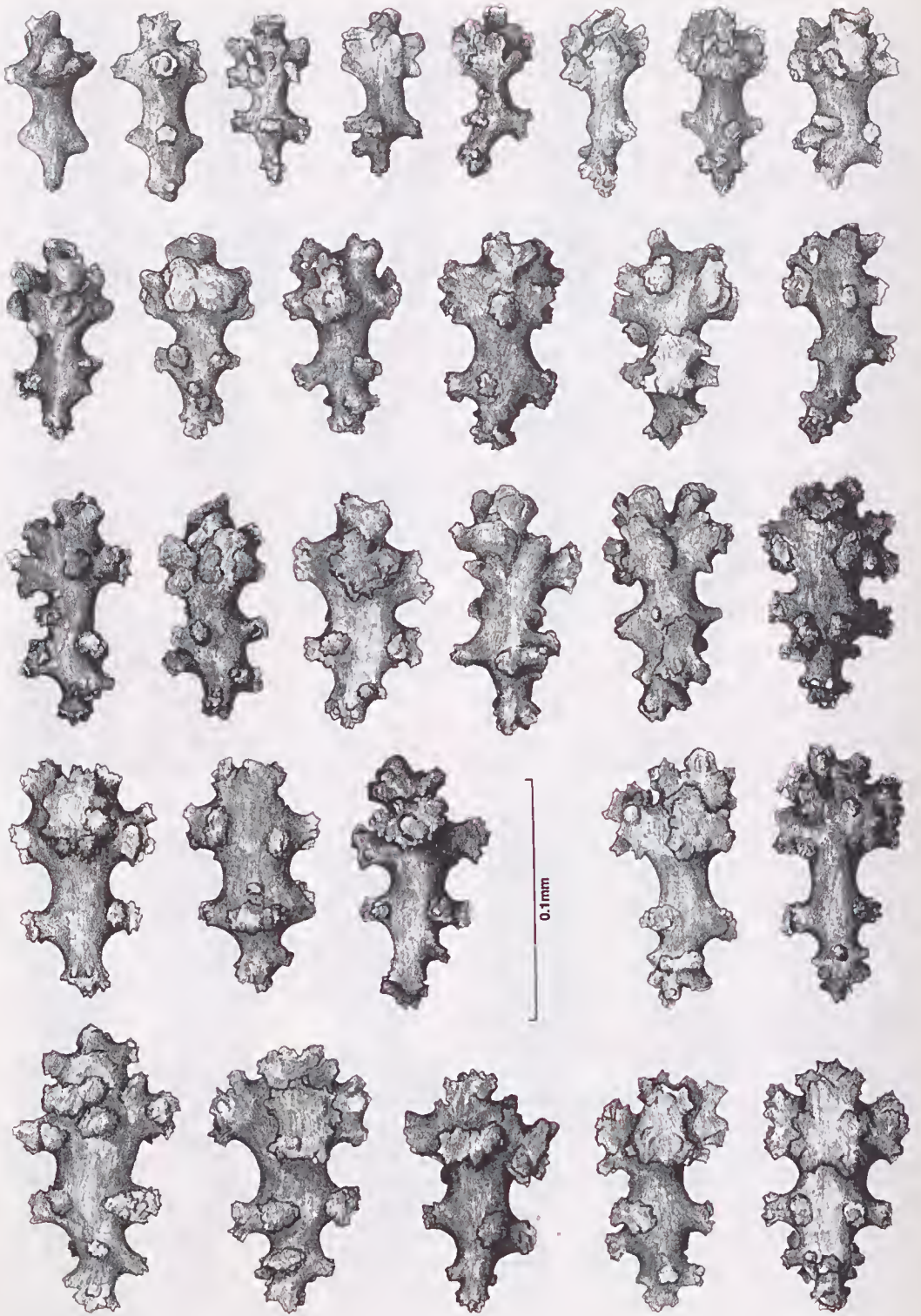


Fig. 24. *Simularia jasmineae*, holotype, sclerites from the surface of the base.



longer depending on how deep the sample is taken (Fig. 22B).

The polyps do not contain sclerites.

A sample from the upper part of the interior of a lobe is remarkable for containing mostly small spindles, up to 0.33 mm in length, a few are longer, ornamented with a few simple prominences and often have a distinct waist (Fig. 23A). Along with these are found complexly warted spindles of a similar maximum size (Fig. 23B). Only a few large coenenchymal spindles, characteristic of the genus, occur in this area. They become more common, however, lower down, where fewer

small spindles are found. These large spindles, shown in the upper half of Fig. 23, are relatively plump and cover a large size range from about 0.50 mm - 1.60 mm in length, a few approaching 2 mm long. The spindles have high spiny warts (Fig. 23C) which are most densely arranged on the larger sclerites. A significant number of the spindles have a narrow median constriction.

In the surface of the stalk, only a few *leptocladus*-type elubs are found. They are similar to those in the lobes. Most of the clubs in this area have short thick handles and irregular warty heads, and measure about 0.07 - 0.11 mm in

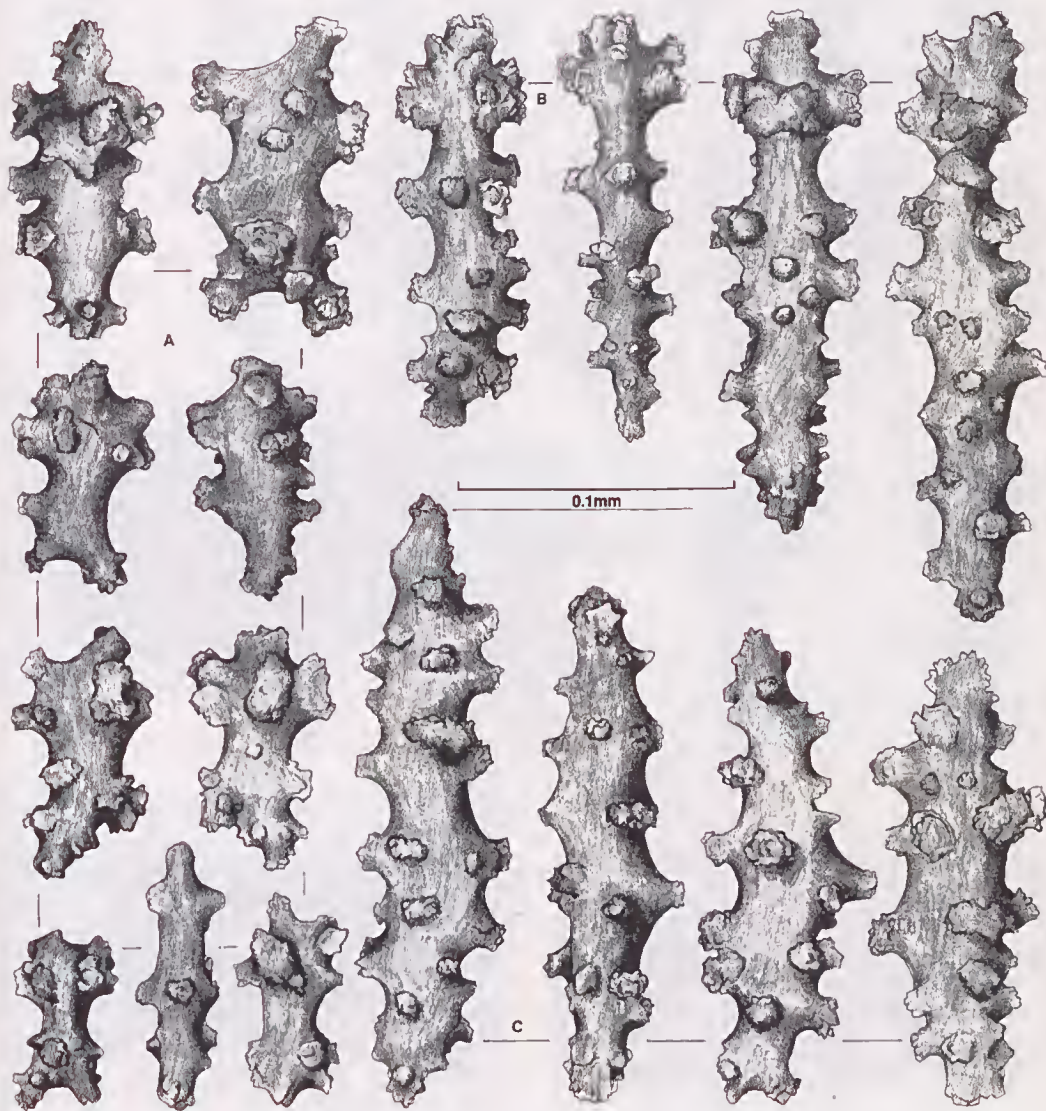


Fig. 25. *Simularia jasmineae*, holotype, sclerites from the surface of the base.

length (Fig. 24). Amongst them are numerous irregularly shaped modified clubs of the same size (Fig. 25A). A few long clubs with cylindrical handles (Fig. 25B), mostly to about 0.15 mm, and some warty spindles to about 0.21 mm, are also found (Fig. 25C). Longer spindles are transitional forms to the interior sclerites.

It should be noted that the stalk coenenchyme is not tightly packed with sclerites as is generally observed with most *Simularia* species. Also the sclerites are not all arranged more-or-less parallel in the direction of the gastric canals as is usually the case. The sclerites can be seen distributed at all angles throughout the coenenchyme. They are numerous but clearly not touching. The pale yellowish nutritive canal system is very visible within the matrix. The colony appears to be contracted to the usual degree observed in alcohol preserved specimens that have not been relaxed

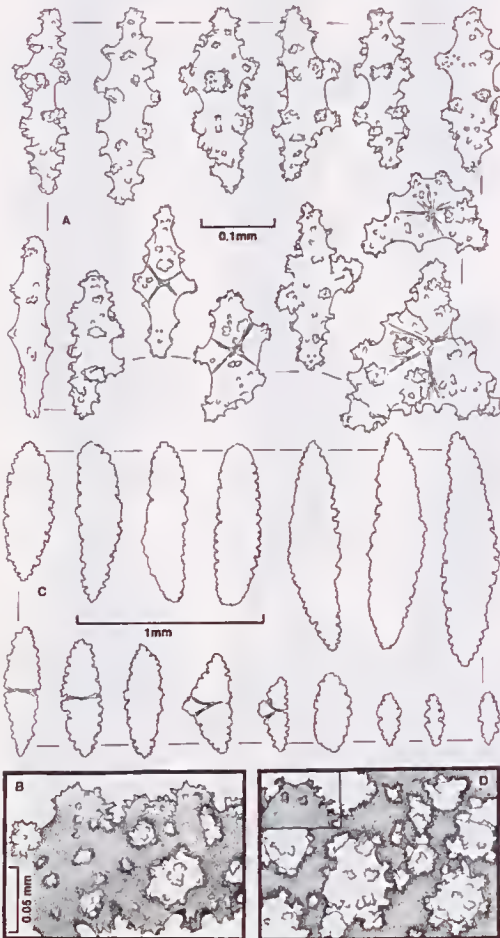


Fig. 26. *Simularia jasminuae*, holotype, sclerites from the interior of the base. B, D, details of warring.

prior to fixing, and the low density of the coenenchymal sclerites does not seem to be an artifact.

Samples from the basal coenenchyme have noticeably few large spindles. As in the interior of the lobes there are numerous small pointed spindles, about 0.18 - 0.30 mm, with sparse warring (Fig. 26A). The warts, however, unlike those of the lobe sclerites, are dome-shaped with spiny summits (Fig. 26B). The larger, heavily warty spindles that do occur, are more slender than those in the lobes (Fig. 26C). Although up to 1.60 mm in length, most are smaller. The smaller ones tend to have the warts in whorls and many of the more oval forms, especially the few with a waist, resemble the interior sclerites more typical of *Lobophytum* or *Sarcophyton*. The warts on the larger spindles are high and complex (Fig. 26D) and very densely arranged on the longest sclerites.

**Etmology.** This species is named after Miss Jasmine Jan, of the Northern Territory Museum, for the countless hours spent making the drawings for this publication.

**Remarks.** None of the nominal *Simularia* species with *leptoclados*-type clubs have a colony morphology quite like that of the new species,

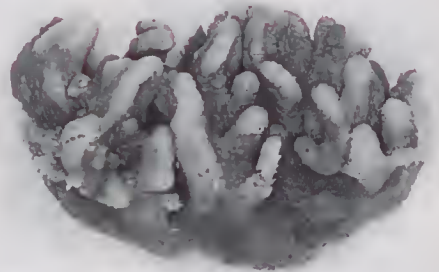


Fig. 27. *Simularia parulekari*, holotype. Natural size.

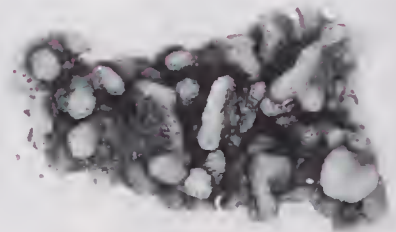


Fig. 28. *Simularia parulekari*, holotype. Natural size.



Fig. 29. *Simularia parulekari*, holotype, sclerites of the surface of the lobes.

although some may be considered similar, e.g. *S. inelegans* Tixier-Durivault, 1970b. None of the similarly looking colonies have sclerites resembling those of *S. jasmineae*. If the lower right hand portion of the holotype of *S. facile* Tixier-Durivault, 1970b, is considered, as figured by Verseveldt (1980: pl.13, fig. 3), then the colony morphology of this species could be similar to that of *S. jasmineae*. (Observations of live *Simularia* colonies clearly shows that many species, particularly the low encrusting forms, do not always maintain

the same morphology over the whole colony). The sclerites of the surface of lobes of *S. facile* are similar to those of *S. jasmineae*, but the clubs of the stalk surface are larger and do not quite match those of the new species, and the sclerites of the interior of the lobes and stalk are quite different. It should be noted here that the epithet *facile* is an incorrect original spelling, being the neuter form of the Latin adjective *facilis*. This has been pointed out to me by Dr Frederick Bayer (pers. comm.). The name is herein corrected to *Simularia*

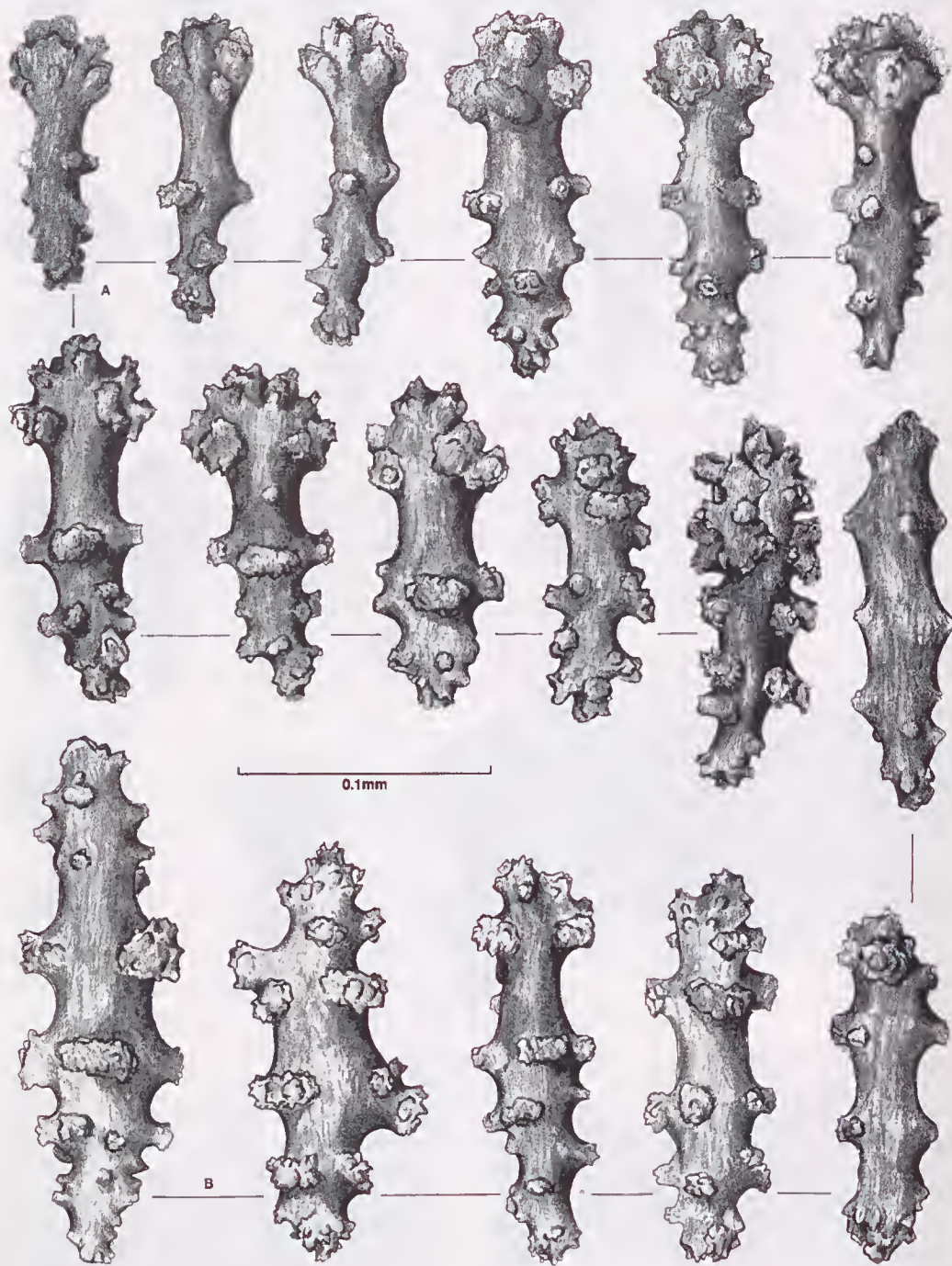


Fig. 30. *Simularia parulekari*, holotype, sclerites of the surface of the lobes.

*facilis* in accordance with Article 32d of the International Code of Zoological Nomenclature.

*Sinularia parulekari* sp. nov.  
(Figs. 27-35)

**Type material.** HOLOTYPE - NTM C5966: Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E, 5-7 m, December 1985, coll. P. Shirwaiker.

**Description.** The small upright colony is 50 mm at its longest diameter, 23 mm at its widest, and 30 mm high (Figs 27,28). The height of the stalk varies from about 9-20 mm. The polypary is divided into 3 main lobes which bear numerous small lobules of various shapes. Some are simple digitiform knobs about 3-6 mm high and 3-4 mm wide. Others are flattened laterally and twisted, up to 13 mm x 2 mm and 12 mm high. The largest lobe is irregularly flattened with knob-like protrusions on one side and is 17 mm long and 15-20 mm high.

The surface of the lobules is covered with small deep pits, about 0.06 mm between centres, marking the retracted autozooids. Here and there a few anthocodiae have not fully retracted and the anthocodial sclerites are quite visible. The colony appears to have suffered considerable abrasion as the surface of the tallest lobules and areas of the stalk are worn away revealing the large interior coenenchymal sclerites.

The colour of the firm colony is brown and the tips of the abraded lobules are quite pale.

The surface of the lobules contains small clubs of the *leptocladus*-type, about 0.07 - 0.11 mm in length (Fig. 29). A few are larger that are transitional forms to the longer warty headed

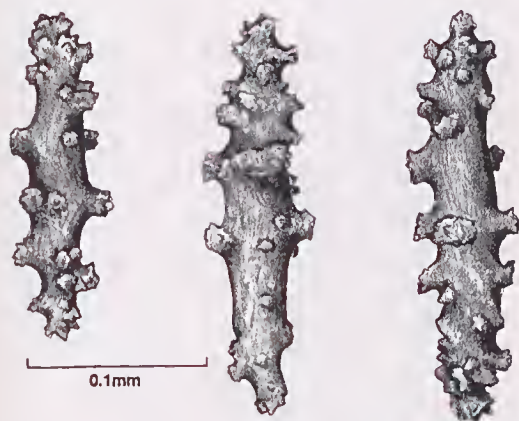


Fig. 31. *Sinularia parulekari*, holotype, sclerites of the surface of the lobes.

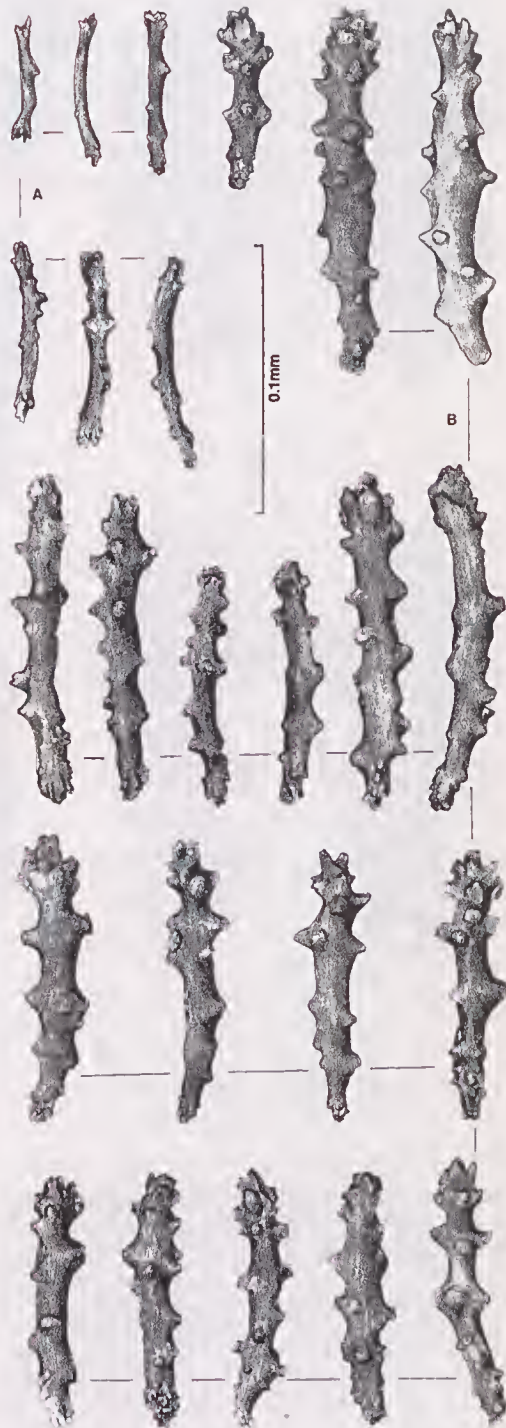


Fig. 32. *Sinularia parulekari*, holotype, sclerites of the polyps.

clubs, up to 0.16 mm long, that occur in small numbers in this layer (Fig. 30A) along with some narrow spindles, up to 0.20 mm long, that have warts often in zones (Fig. 30B,31). A few plump spindles, larger than 0.20 mm, with large complex warts, are more commonly found in the interior of the lobules.

It is difficult to assess the exact sclerite arrangement in the tightly retracted polyps. In

the base of each tentacle there are about 6 slender, poorly developed clubs, up to about 0.15 mm long, and placed horizontally below these are one or two bent spindles of a similar size (Fig. 32B). There are also a small number of rodlets in the polyps (Fig. 32A). The smaller ones, about 0.05 - 0.07 mm long, appear to come from the tentacle rachis, while the occasional larger form, to 0.09 mm, may occur with the clubs in the tentacle bases.

The interior of the lobules has large, densely warted, rather plump spindles, occasionally forked, up to about 2.90 mm long, and along with these are smaller pointed spindles, mostly 0.30 - 1.00 mm, covered with the same form of large warts (Fig. 33). On the shortest of these pointed spindles the warts are not as densely arranged. The complexity of the warts on the coenenchymal spindles varies, as shown in Fig. 33A-C, with the spikiest form occurring in the densest arrangement.

The surface of the stalk has many small elubs similar to those in the lobules. Amongst these are numerous sturdier forms with thicker handles and heads with sharper processes (Fig. 34A). Larger clubs up to about 0.13 mm also occur, some of which have warty heads that are not very *leptocladus*-like (Fig. 34B). Amongst the clubs small numbers of short plump spindles occur, up to 0.16 mm in length. Some are irregularly warted but many have a distinct waist and the warts arranged in zones (Fig. 34C).

The interior of the base has two types of sclerites (Fig. 35). The largest are relatively stout spindles that may have small bifureations. These sclerites are mostly less than 3 mm, some reach 3.70 mm in length. Mingled with these long spindles are numerous small oval sclerites similar in size and structure to those found in the basal interior of *Sarcophyton trocheliophorum* von Marenzeller, 1886. Some are irregularly warted and others are capstan-like with a distinct waist and two whorls of warts (Fig. 35B). These sclerites, together with a few longer forms with many whorls of warts (Fig. 35A), are quite distinct. The warting of all the basal coenenchymal sclerites is like that shown in Fig. 33C.

**Etymology.** The specific name acknowledges the friendship of Dr Arun Parulekar, Head of the Biological Oceanography Division of the National Institute of Oceanography, India, and his assistance with this project.

**Remarks.** The only species with *leptocladus*-type clubs and colony morphology similar to that of *S. parulekari* are *S. erecta* Tixier-

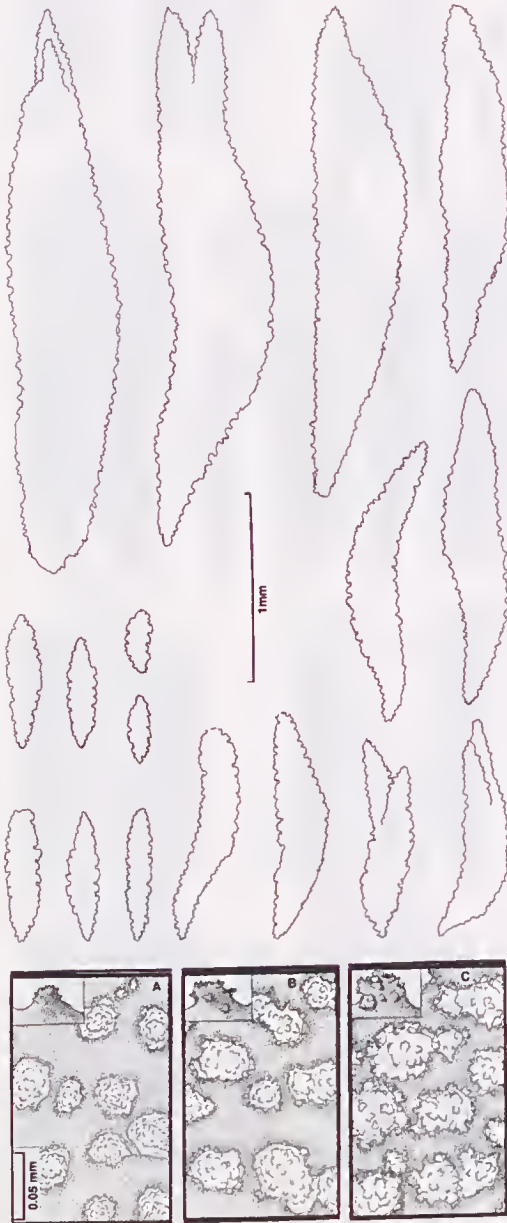


Fig. 33. *Simularia parulekari*, holotype, sclerites of the interior of the lobes. A, B, C, details of warting.

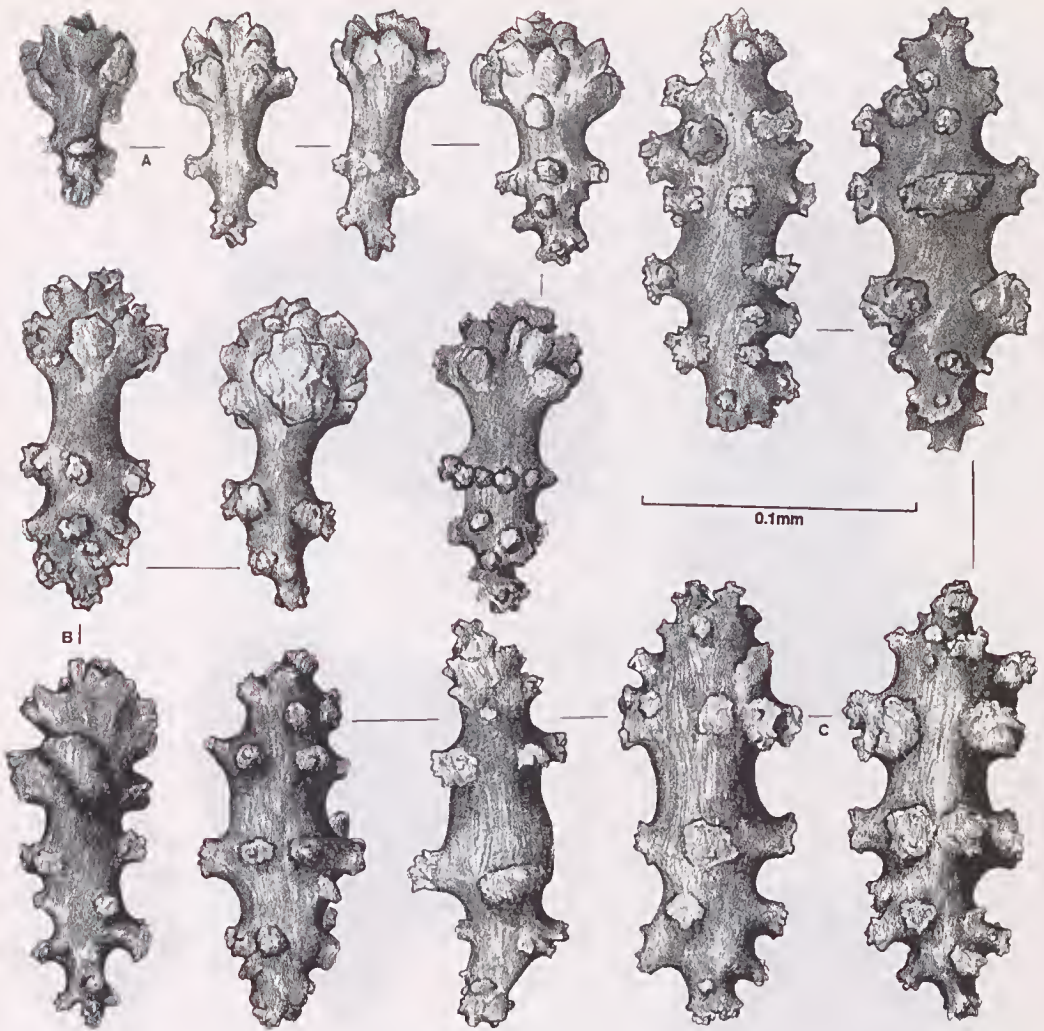


Fig. 34. *Simularia parulekari*, holotype, sclerites of surface of the base.

Durivault, 1945, and *S. exilis* Tixier-Durivault, 1970b. Both of these species have elubs and waisted spindles like the new species. The robust elubs of the lobe surface of *S. parulekari* (Fig.30A) do not appear to occur in either species, although Verseveldt (1980:50) did state that in *S. erecta* "Longer elubs, about 0.13 mm long, have heads with less leaf-like prominences". The most distinctive difference between *S. erecta*, *S. exilis* and the *S. parulekari* is the presence in the latter of the small oval sclerites amongst the large spindles of the basal coenenchyme. Such oval sclerites do occur in *S. muralis* May, 1889, but the colony form and surface sclerites of this species are quite different from the new species.

*Simularia kavarattiensis* sp. nov.  
(Figs 36-41)

**Type Material.** HOLOTYPE - NTM C5992; PARATYPES - NTM C5991, C5993, C5994, C5995: Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E, coll. P. Shirwaiker.

**Description.** The holotype (Fig. 36A) is a small colony (apparently complete), 60 mm high by about 32 mm wide, consisting of two primary lobes branching from just above the common base. Each lobe branches 20-30 mm above the base into a mass of small rounded, knob-like or digitiform, lobules, 2-5 mm wide and 2-10 mm long.

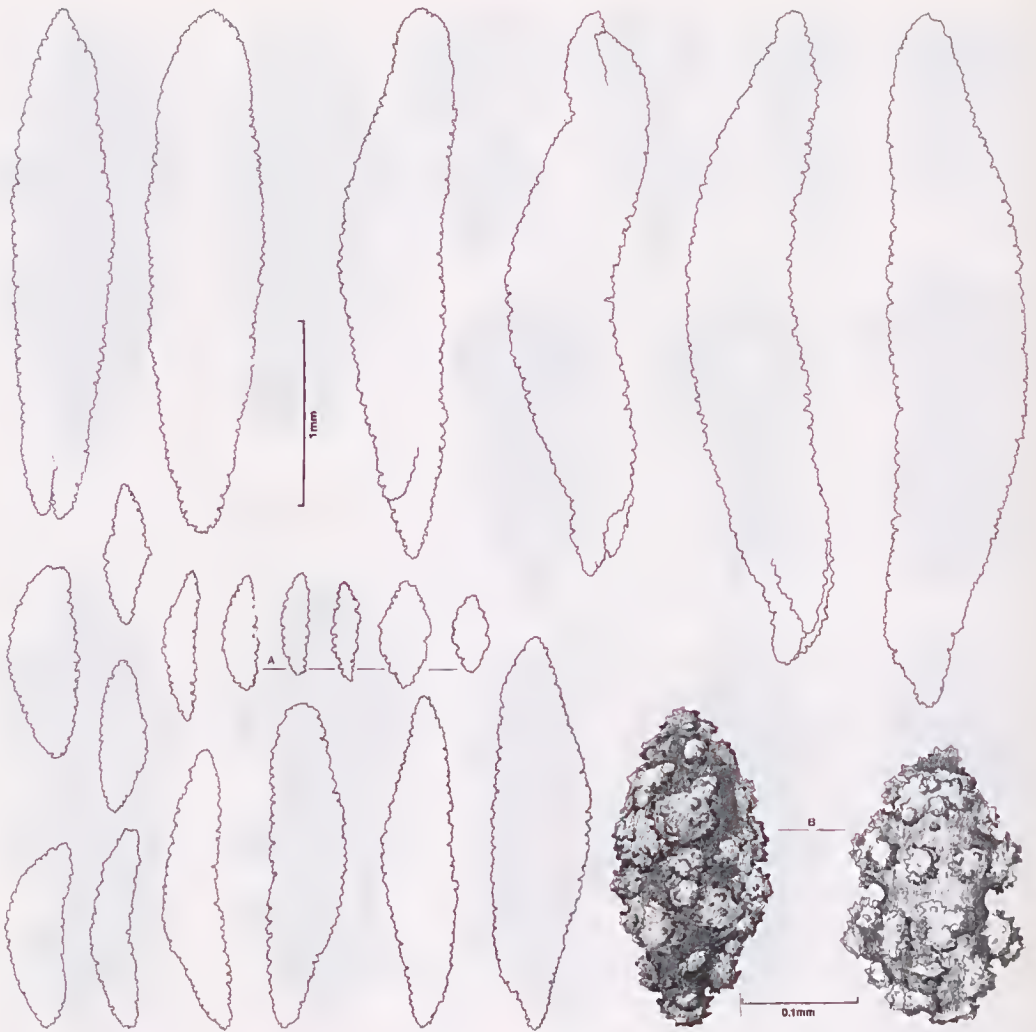


Fig. 35. *Simularia parulekari*, holotype, sclerites of the interior of the base.

The surface of the lobules is wrinkled and covered with shallow pits and irregular grooves associated with the retracted autozooids.

The colony is not uniformly coloured, and the patchiness shows evidence of the specimen being compressed with other colonies during fixing. Some areas are nearly black, some dark brown and others are pale to very pale brown. The basal areas are quite firm but the lobules are soft and flexible.

The surface of the lobes and lobules contains clubs, mostly 0.05 - 0.16 mm in length, and a few up to 0.18 mm long (Fig. 37). The smallest clubs, up to about 0.11 mm are clearly of the *leptocladus*-type, although the prominences on the heads of some are quite divergent. Some of the clubs,

usually amongst the smaller ones, have foliaceous expansions on the handle (Fig. 37A). The longer the club the less it looks as though it is derived from the *leptocladus*-type. Below the elubs there are long slender spindles ornamented with simple processes (Fig. 38A). The shorter ones, up to about 0.25 mm long, often have the simple warts clustered at each end with the middle zone nearly smooth. The larger forms usually have a more even distribution of warts and can be as long as about 0.36 mm, although this is not common.

In the surface of the lobes there are also long slender clubs of a modified *leptocladus*-type. These are from the polyps (Fig. 37B) and are mostly 0.08 - 0.13 mm in length. The anthoecodiae



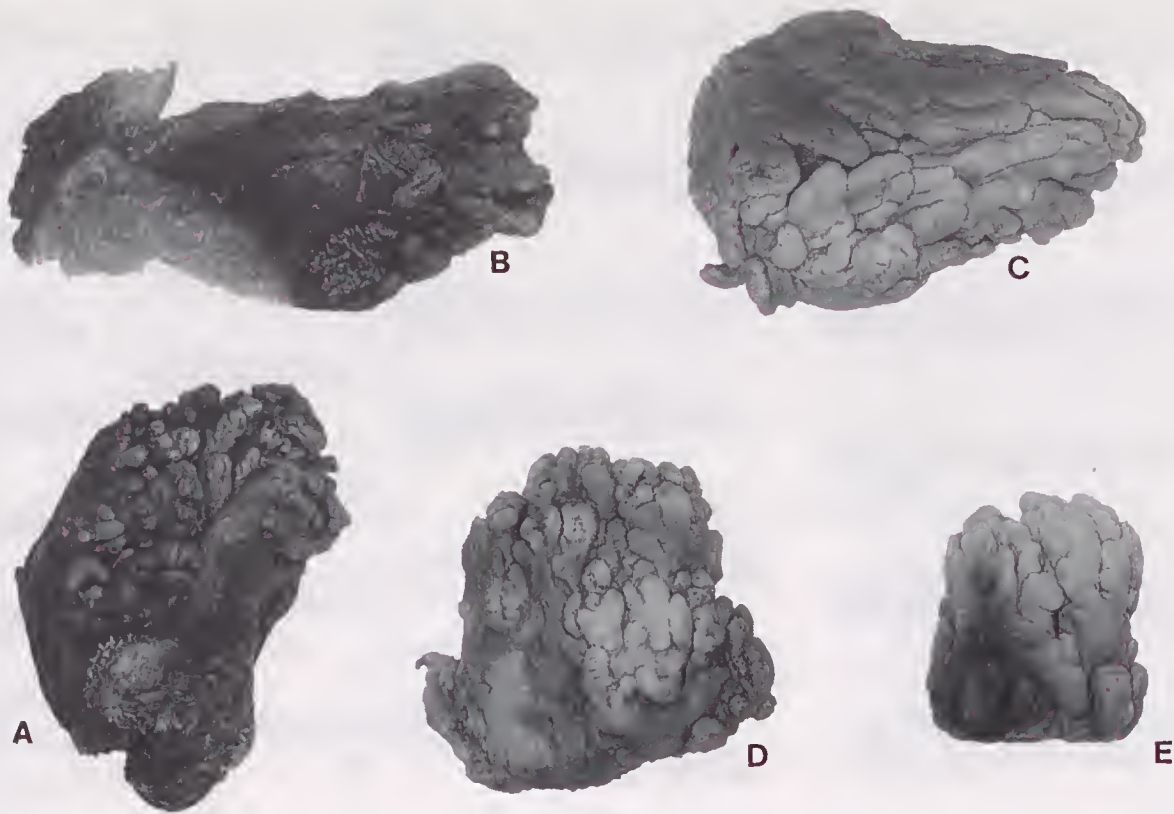


Fig. 36. *Simularia kavarattiensis*, A, holotype. B-E, paratypes. Natural size.

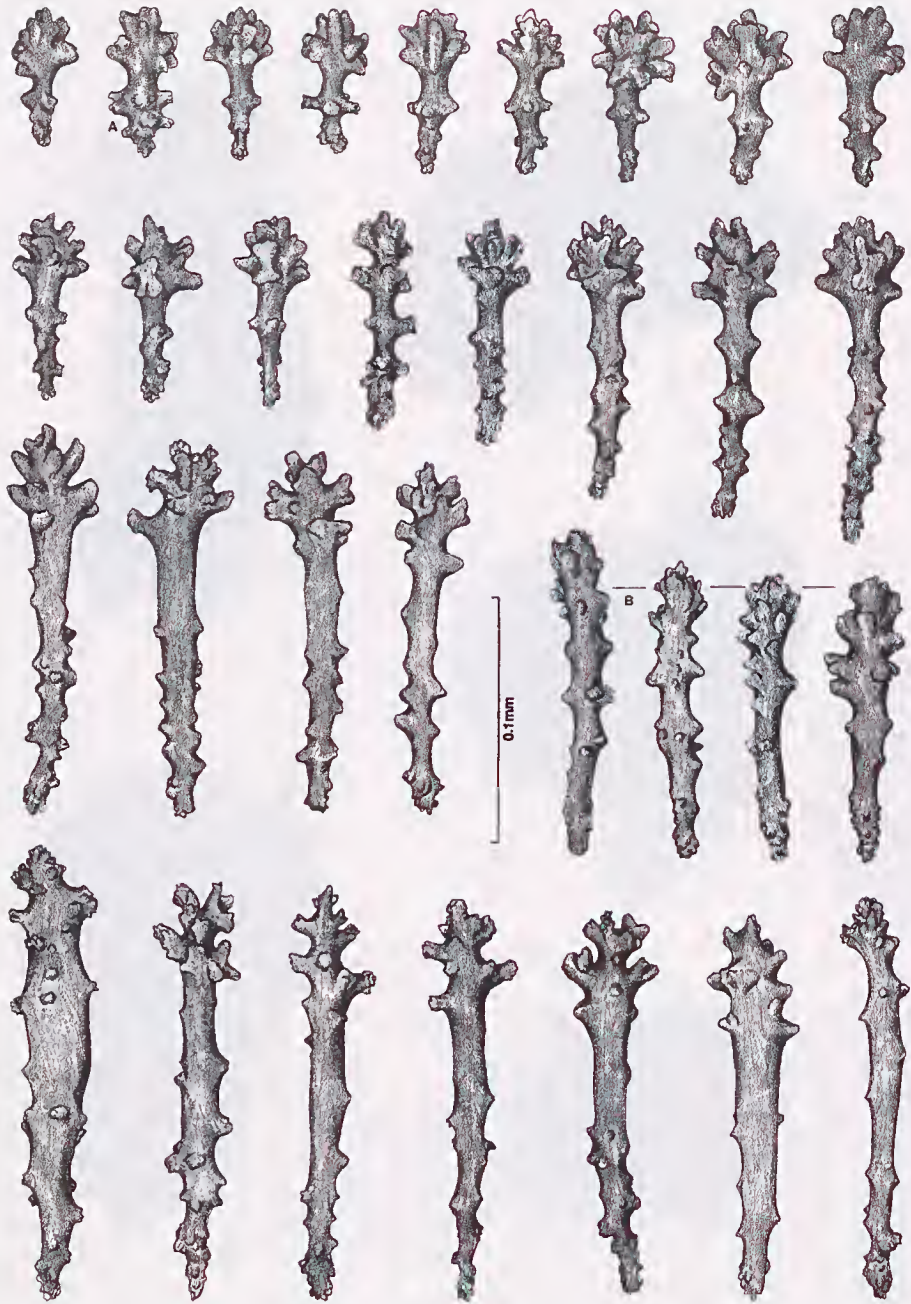


Fig. 37. *Simularia kavarttiensis*, holotype, sclerites from the surface of the lobes.

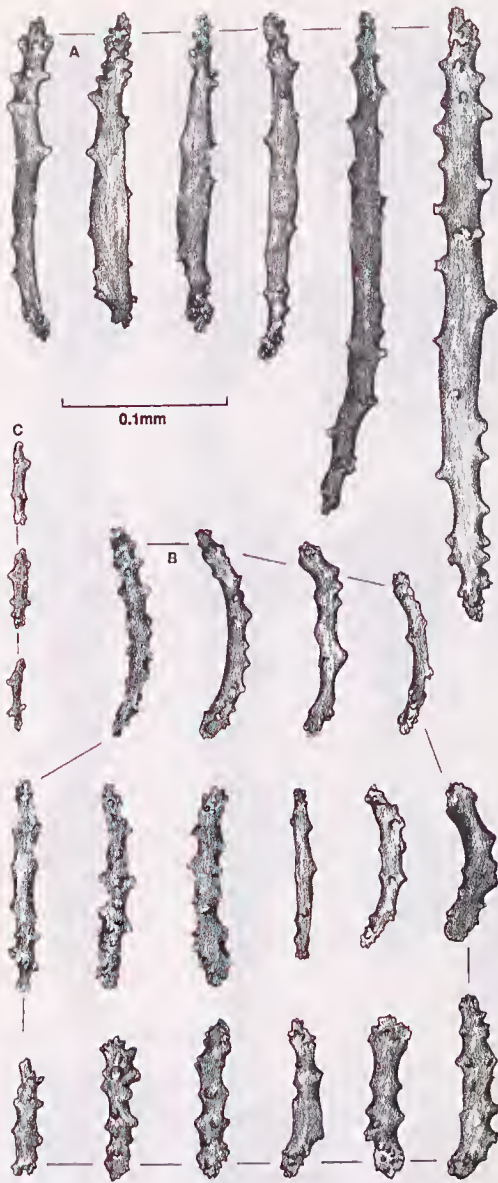


Fig. 38. *Simularia kavarattiensis*, holotype, A, sclerites from the surface of the lobes. B, C, sclerites from the polyps

also contain small rods, about 0.07 - 0.13 mm in length, some flattened, many curved (Fig. 38B), and smaller rodlets from the tentacles, about 0.05 mm long (Fig. 38C).

The interior of the lobes contains slender curved spindles, up to about 1.90 mm long (Fig. 41B), mostly smaller, with high complex warts that are not densely arranged (Fig. 41A).

The surface of the stalk contains clubs, about 0.06 - 0.20 mm long (Fig. 39, 40). The small ones,

up to about 0.11 mm, have heads of the *leptoclados*-type similar to those in the lobes, but the handles are thicker. The longer clubs may also have modified *leptoclados*-type heads, but many of the larger forms have thick handles and irregular warty heads. There are also some spindles, like those found in the lobe surface (Figs 38A, 40A), but only to about 0.26 mm in length.

The large spindles of the stalk interior are fatter and longer than those in the lobes (Fig. 41C). They are up to about 2.60 mm long and ornamented with complex warts, not densely arranged, and larger than those of the lobe sclerites (Fig. 41D, E). Amongst the long spindles are numerous smaller forms, up to about 0.40 mm long (Fig. 41F). Some are ornamented with scattered complex warts, and others have simple cone-shaped prominences.

**Etymology.** The specific name refers to the type locality.

**Remarks.** There is a notable similarity between the shape of the long clubs of both the lobe and stalk surfaces of *S. kavarattiensis* and those found in *S. lochmodes* Kolonko, 1926. The colony form of these two is also similar. The smaller clubs of *S. lochmodes*, however, are not of the *leptoclados*-type, although they could be derivatives of them. In an attempt to obtain some evidence for *S. kavarattiensis* being a variant of *S. lochmodes*, fragments from the holotypes of *S. lochmodes* and the synonymised species (Verseveldt 1980: 81) *S. partita* Tixier-Durivault, 1970a, *S. dumosa* Tixier-Durivault, 1970b, and *S. ramulosa* Tixier-Durivault, 1970b, were examined. The same sclerite forms as illustrated by Verseveldt (1980: fig. 39) occur in all of the specimens, which were collected from the Philippines, New Caledonia and Vietnam. Foliaceous clubs like those present in *S. kavarattiensis* were not seen in these preparations. The very long clubs, up to 0.28 mm, that occur in *S. lochmodes* are not found in the new species, and neither are the very long internal spindles with the very large warts. The two species are considered to be distinct.

*Simularia kavarattiensis* also has a colony form similar to that of *S. leptoclados* (Ehrenberg, 1834), although the lobules are relatively small in comparison, and it is necessary to distinguish between the two species. This is easily done by considering the long warty clubs and slender spindles of the surface layers of *S. kavarattiensis* which do not occur in *S. leptoclados*. It has been possible to examine a small fragment of the holotype of *S. leptoclados* var. *gonatodes*, which

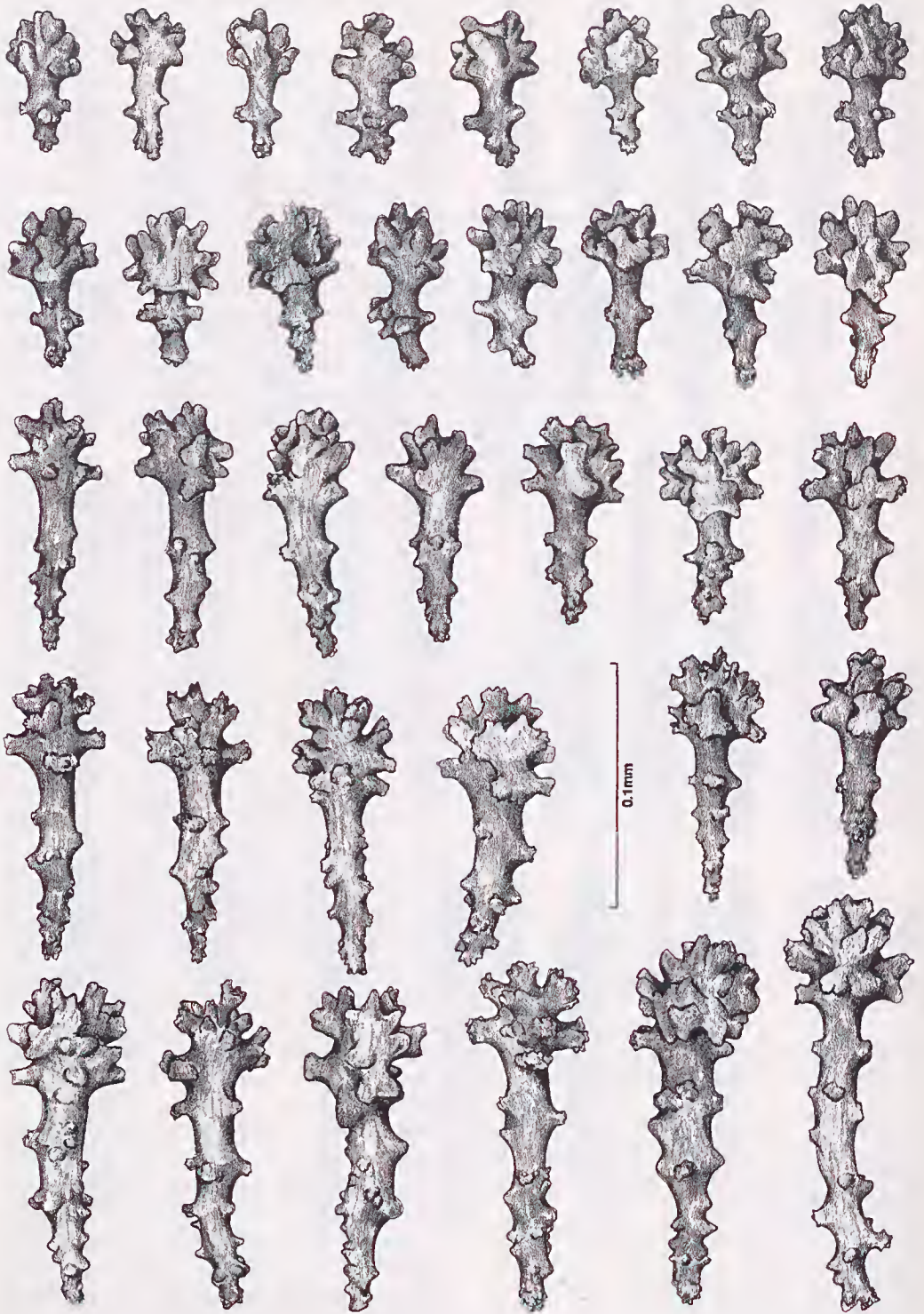


Fig. 39. *Simularia kavarttiensis*, holotype, sclerites from the surface of the base.

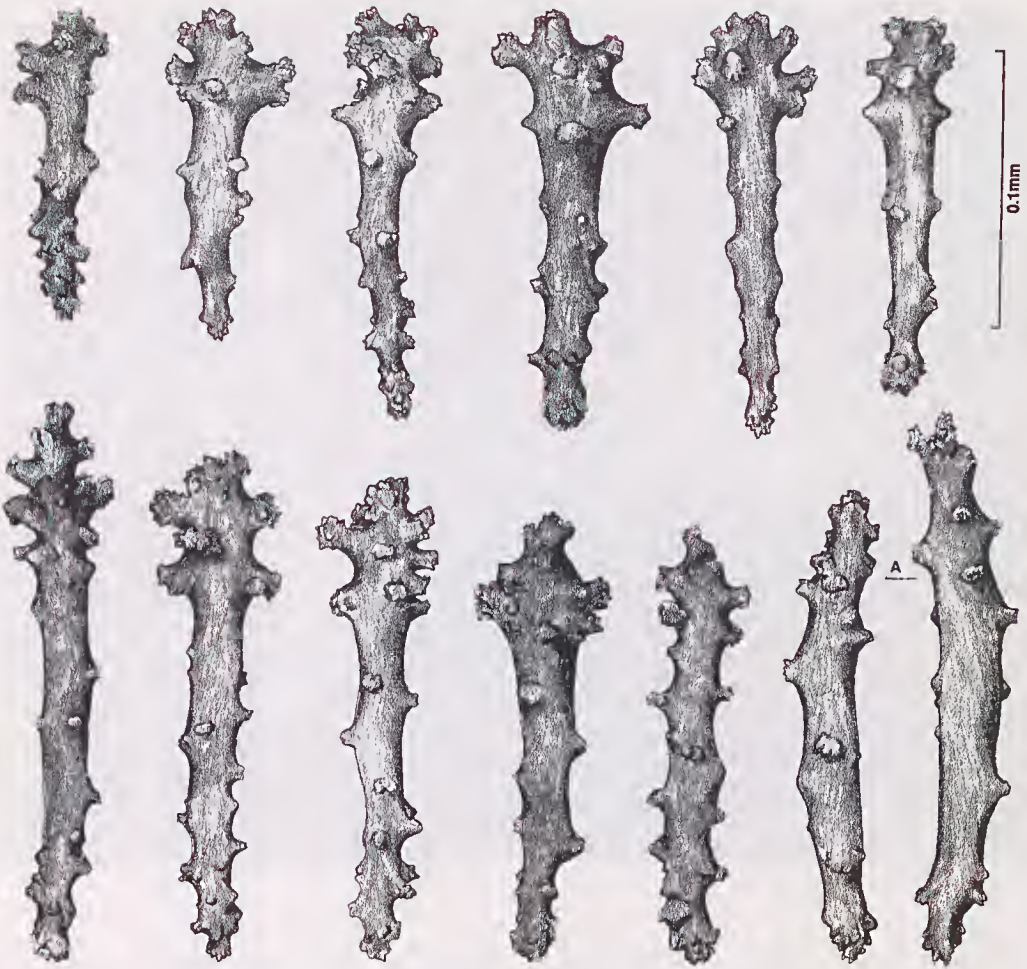


Fig. 40. *Sinularia kavarattiensis*, holotype, sclerites from the surface of the base.

Verseveldt (1980) considered to be synonymous with *S. leptoclados*. In the surface of the lobes there are numerous small rods, about 0.12 mm long, similar to those illustrated by Verseveldt (1980: fig. 17f) for *S. dissecta*. These sclerites, presumably present in *S. leptoclados* but not illustrated in Verseveldt's (1980) figure 38, are not found in *S. kavarattiensis*.

The four paratypes (Fig. 36B-E) do not have enough basal material intact to establish whether they represent individual colonies or are lobes torn from larger colonies. Each piece has the polypary divided into lobules of similar dimensions to those of the holotype, although a dominance of larger size lobules exists in two of the specimens. Here and there, patches of partially expanded autozooids can be seen. All of the specimens show varying degrees of patchiness in

their black, brown, and pale brown colouration, and exhibit the same characteristic irregular patterning of pits and ridges on the lobes as seen in the holotype. There are no significant differences between the sclerites of the paratypes and those of the holotype.

*Sinularia gaveshaniae* sp. nov.  
(Figs 42-48)

**Type material.** HOLOTYPE - NTM C 5969: Kavaratti Island, Laccadive Archipelago, 10°35'N, 72°36'E. 5-7 m, December 1985, coll. P. Shirwaiker.

**Description.** The holotype (Fig. 42) consists of two portions from the original colony. The largest piece is 67 mm long by about 32 mm at its widest. The surface of the side of the specimen,

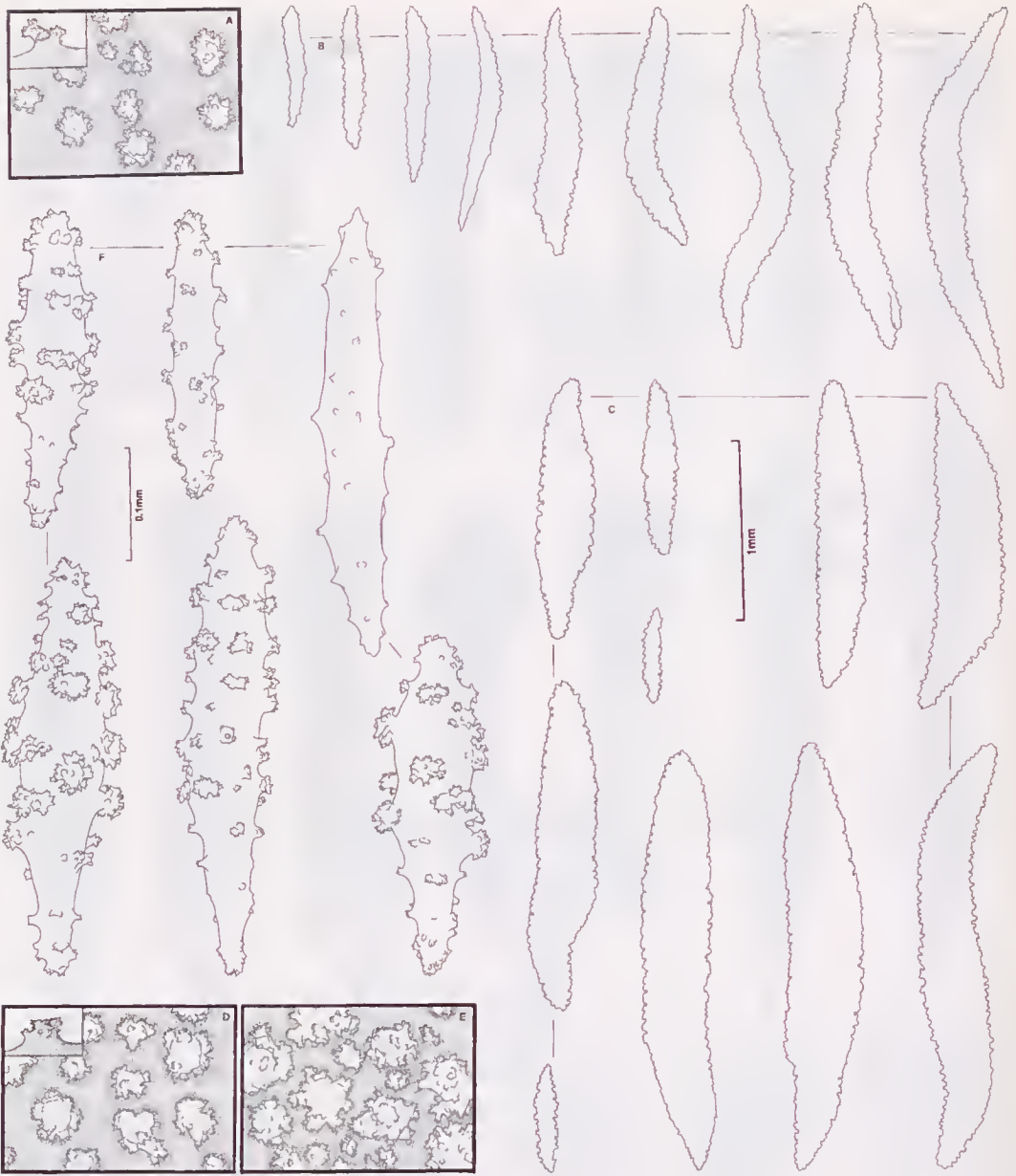


Fig. 41. *Simularia kavarttiensis*, holotype. A, detail of warring of sclerites from the interior of the lobes. B, sclerites of the interior of the lobes. C, F, sclerites of the interior of the base. D, E, details of warring of sclerites of the interior of the base. A, D, E, F, same scale. B, C, same scale.

10-40 mm high, merges into the lobed edge of the capitulum. Several autozooids occur on the side below the lobes. The actual base of attachment is missing and the aspect of the specimen suggests that it may have been torn from the edge of a dish-shaped colony. On the upper surface of the specimen are three primary lobes that each divide into 3 or 4 more-or-less parallel erect and slightly

flattened digitiform processes, 6-18 mm tall and 5-8 mm wide. There are also a number of similarly shaped processes that arise direct from the surface of the polyparium, the largest of these being 25 mm tall by about 8 mm wide.

The smallest of the holotype portions is about 40 mm tall and 35 mm at its greatest width. The surface of the stalk varies from 12-20 mm high



Fig. 42. *Simularia gaveshaniae*, holotype. Natural Size.

and merges into a lobed ridge around the edge of the polypary, which consists of erect digitiform lobes. The largest lobe is 40 mm high, flattened, and tapers from a base 15 mm at its widest.

The surface of the lobes of the largest piece is quite uneven and covered in minute pits and mounds, each marking where an autozooid has retracted. The lobes of the smallest piece are covered with partially retracted autozooids about 0.40 mm in diameter and, centre to centre, about 0.60 - 0.90 mm apart. The anthocodial sclerites can easily be seen.

The colony is firm but flexible and uniformly coloured very pale yellow.

The sclerites of the upper surface layer of the lobes are virtually all clubs of the *leptoclados*-type (Fig. 43). There is a more-or-less complete gradation of sizes from 0.06-0.16 mm with the smaller forms, like those shown in the first two rows of figure 43, being more common than the larger ones. The longer the club, the more rod-like and relatively stouter the handle, and less

*leptoclados*-like the head. The largest of these clubs often have a narrow constriction below the head (Fig. 43A). There are also a few rods, up to 0.20 mm long, with a cluster of prominences at one end (Fig. 43B). Below this club layer are narrow warty spindles up to 0.32 mm long (Fig. 44). Amongst them are a few fatter, complexly warty spindles, up to 0.50 mm in length similar to those occurring in the basal interior (Fig. 48C).

In the bases of the polyp tentacles are slender clubs of a modified *leptoclados*-type, 0.11 - 0.16 mm long (Fig. 45A). There are bundles of 12-16 clubs in each octant and below these are 2-3 horizontally placed curved rods (Fig. 45B) which may be longer than the clubs. The tentacles also contain a few granular rodlets 0.04 - 0.10 mm long (Fig. 45C).

The interior of the lobes contains large spindles, plump or narrow, sometimes curved and occasionally very branched, up to 3.50 mm long but mostly less than 2.8 mm (Fig. 46). The branched forms may not show up in every sample.

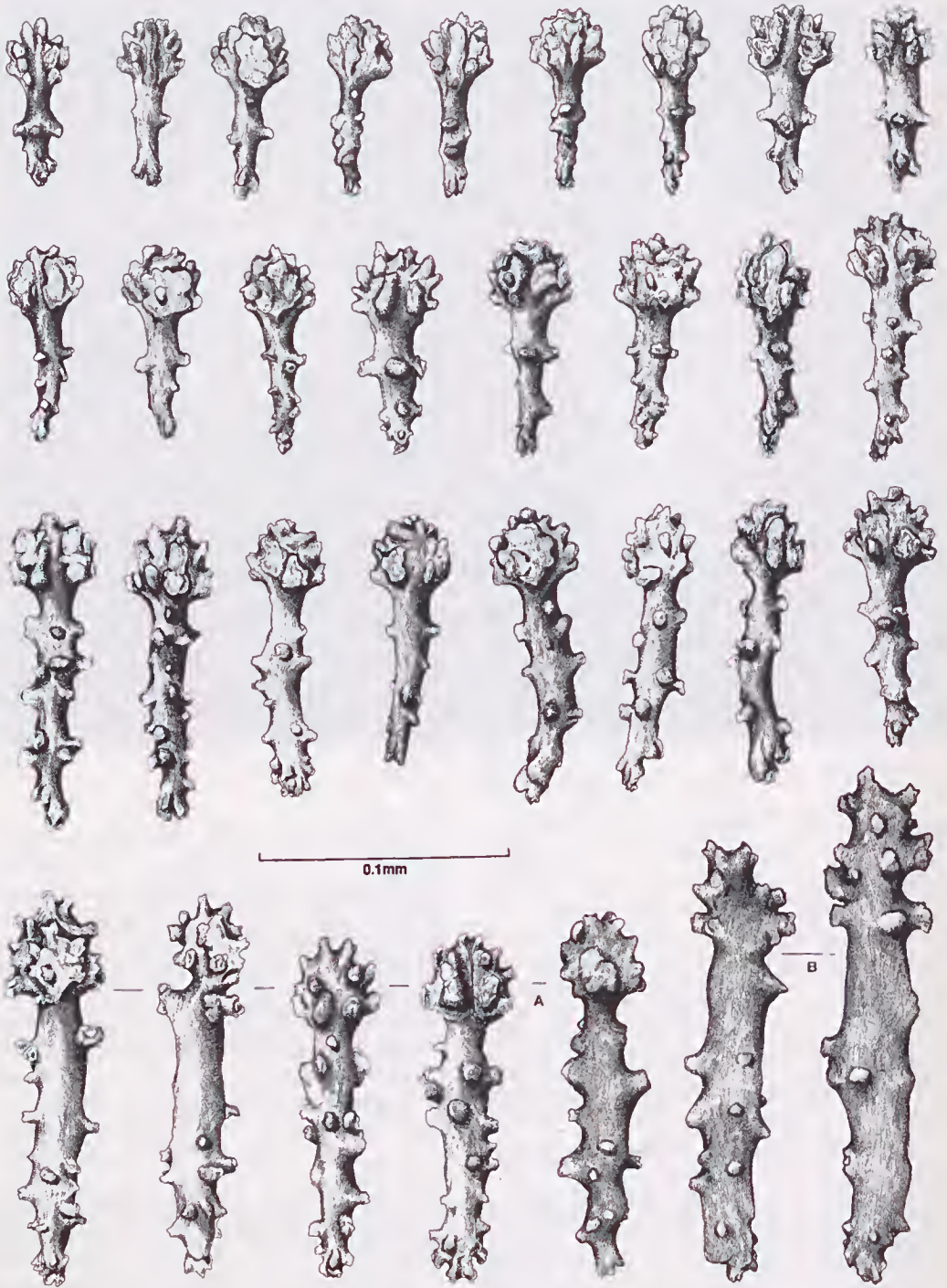


Fig. 43. *Sinteraria gaveshaniae*, holotype, sclerites from the surface layer of the lobes.



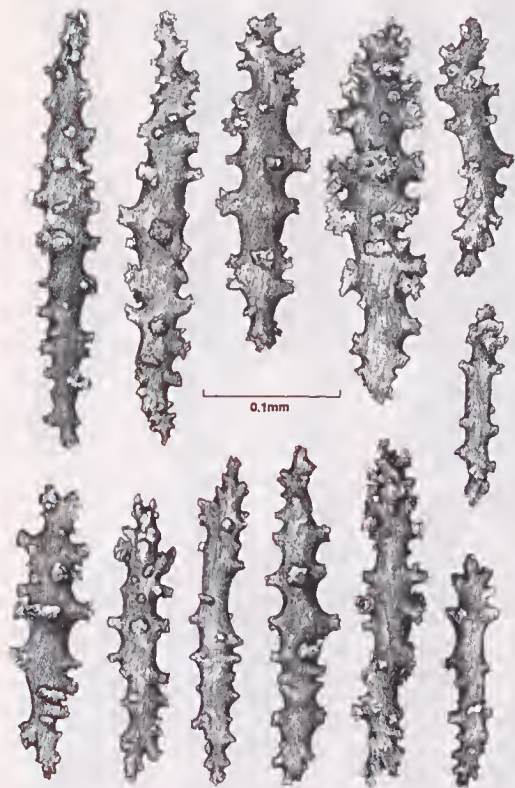


Fig. 44. *Simularia gaveshaniae*, holotype, sclerites from the surface layer of the lobes.

The complex warts of the large spindles have clusters of sharp processes and are arrayed in transverse rows (Fig. 48D).

Sclerite samples from the surface of the base (Fig 47) are inconsistent. All contain clubs of a similar form to those in the lobes, but they have thicker handles and are more robust in general. Most are 0.07 - 0.13 mm long, but a few are larger. There are also some warty rods to about 0.20 mm in length, some of which are slightly club shaped (Fig. 47B). In some stalk samples there are numerous small clubs with several large warts at the base of the handle and a whorl of large warts just above this (Fig. 47A). The two zones may join to form to one warty complex producing a capstan-like sclerite. Some samples also contain a few of the same narrow necked clubs as found in the lobes (Fig. 43A).

The interior of the base contains two main sclerite types. There are large spindles similar to those in the lobes, not as robust in general, and

rarely forked, mostly less than 2.40 mm long (Fig. 48A). The warts are in transverse rows, mostly larger than those of the lobe sclerites but of the same structure (Fig. 48D). Mingled with these large spindles are numerous small plump spindles, mostly about 0.30 - 0.65 mm long (Fig. 48B) having the same complex warts as found in the longer spindles that look proportionately higher and larger on the small plump forms. There are also numerous spindles with irregular warring, up to about 0.36 mm (Fig. 48C).

**Etymology.** This species is named after the research vessel "Gaveshani", of the Indian National Institute of Oceanography.

**Remarks.** A number of species with *leptocladus*-type clubs have colonies with more-or-less similar morphology to *S. gaveshaniae*. The surface sclerites of *S. compacta* Tixier-Durivault, 1970a, are quite unlike those of the new species. There are a number of similarities with the surface sclerites of the lobes of *S. dissecta* Tixier-Durivault, 1945, but Verseveldt (1980: fig. 17) neglected to mention or illustrate the many thin, nearly smooth rods, up to 0.30 mm long, and the numerous curved rods, up to 0.19 mm long, that occur in the holotype and help to distinguish it from *S. gaveshaniae*. The nature of the longer clubs in *S. facilis* Tixier-Durivault, 1970b, and *S. firma* Tixier-Durivault, 1970a, are quite different from *S. gaveshaniae*. The colony form of *S. inelegans* Tixier-Durivault, 1970b, is somewhat different from that of the new species, but there are considerable similarities between the surface sclerites as illustrated by Verseveldt (1980: fig. 34). An examination of a fragment of the holotype has shown that the very numerous slender rods that occur amongst the clubs are mostly characterised by aggregations of simple prominences at each end, which is more conspicuous than is illustrated in Verseveldt's figures 34g,h. These sclerite forms do not occur in *S. gaveshaniae*. *Simularia fishelsoni* Verseveldt, 1970, has branched coenenchymal sclerites in the lobes, as does *S. gaveshaniae*, but the surface clubs have different shapes. *Simularia terspilli* Verseveldt, 1971, also has branched lobe sclerites and the polyp sclerites are similar to the new species, but the other sclerites do not agree. *Simularia maxima* Verseveldt, 1971, comes reasonably close to *S. gaveshaniae*, and it is important to detail their differences. The clubs in the lobe surface of *S. maxima* are more foliaceous than in the new species, and their size, 0.06 - 0.08 mm or occasionally 0.10, is much smaller. The "spiny needles" occurring in the subsurface of the

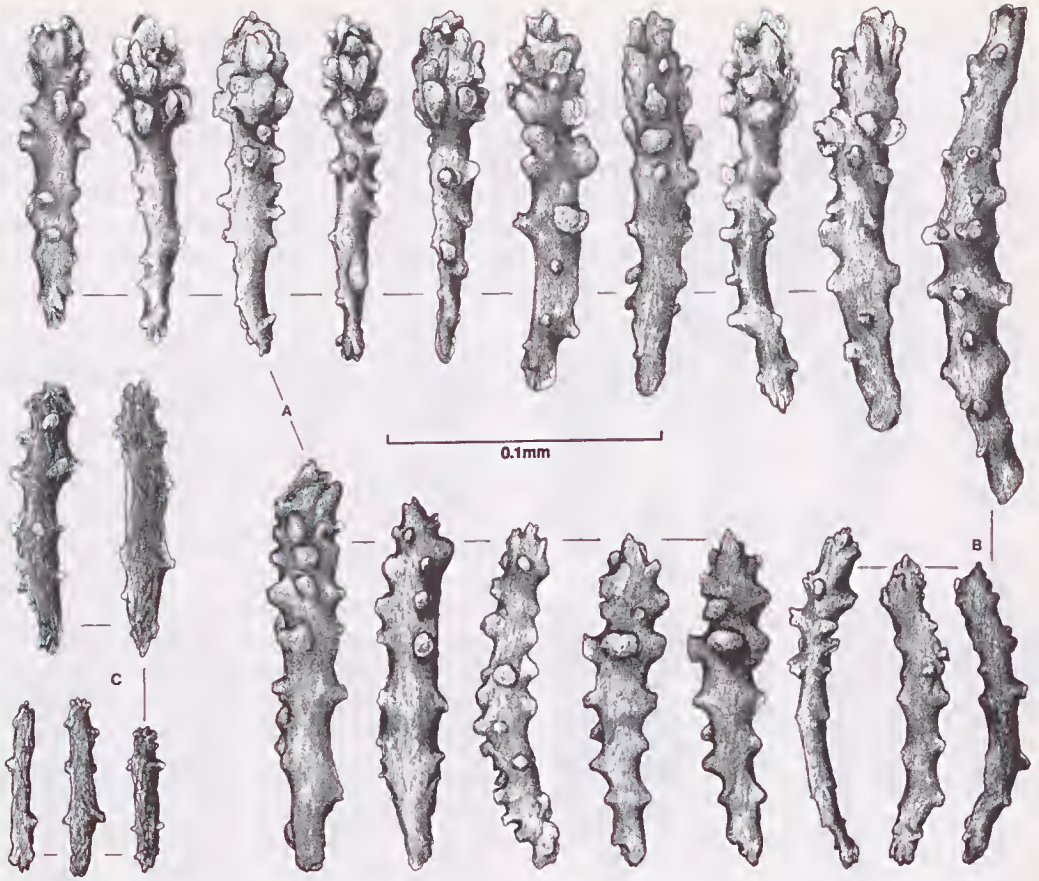


Fig. 45. *Simularia gaveshaniae*, holotype, sclerites from the polyps.

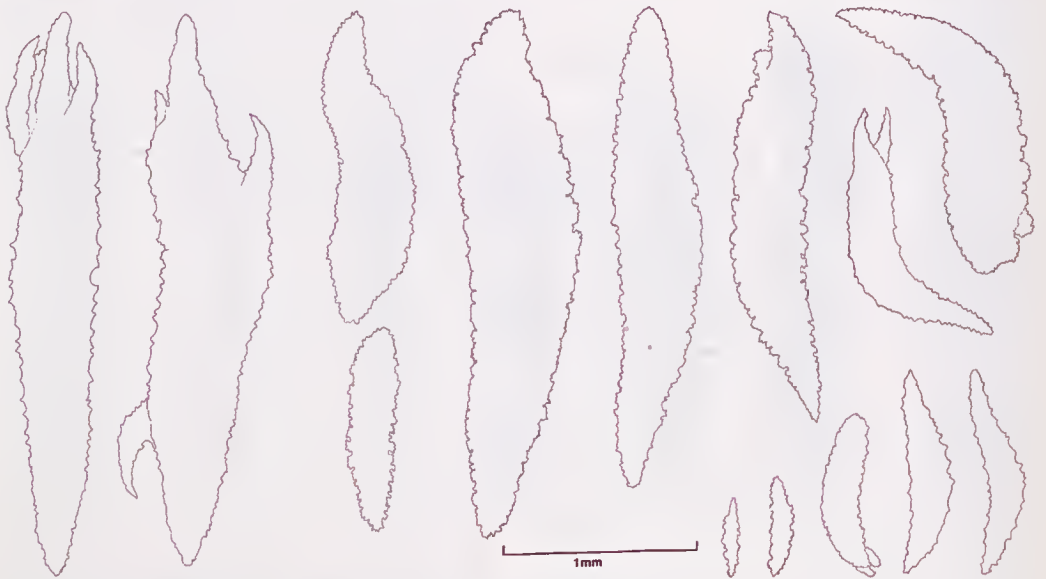


Fig. 46. *Simularia gaveshaniae*, holotype, sclerites from the interior of the lobes.

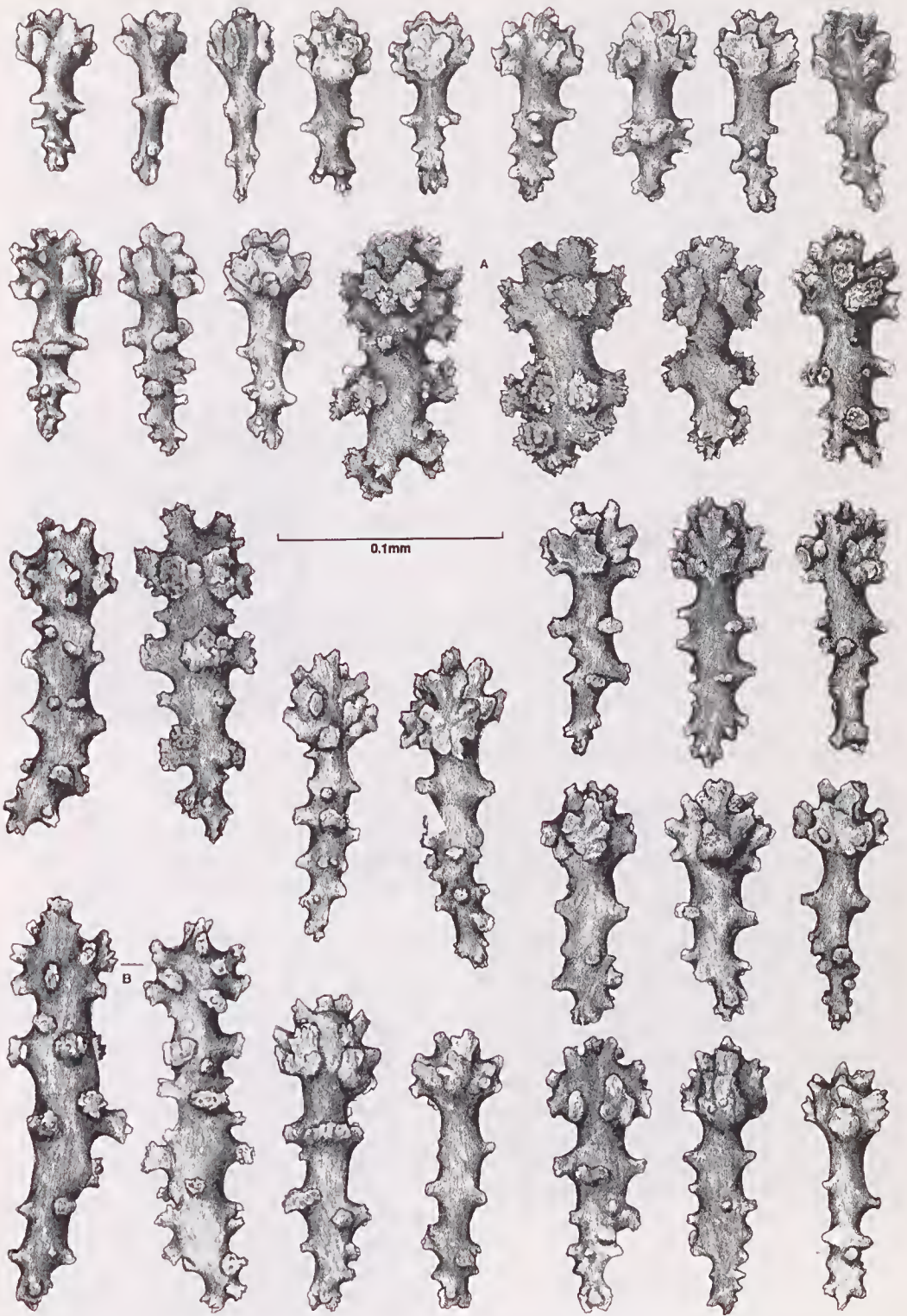


Fig. 47. *Simularia gaveshaniae*, holotype, sclerites from the surface of the base.

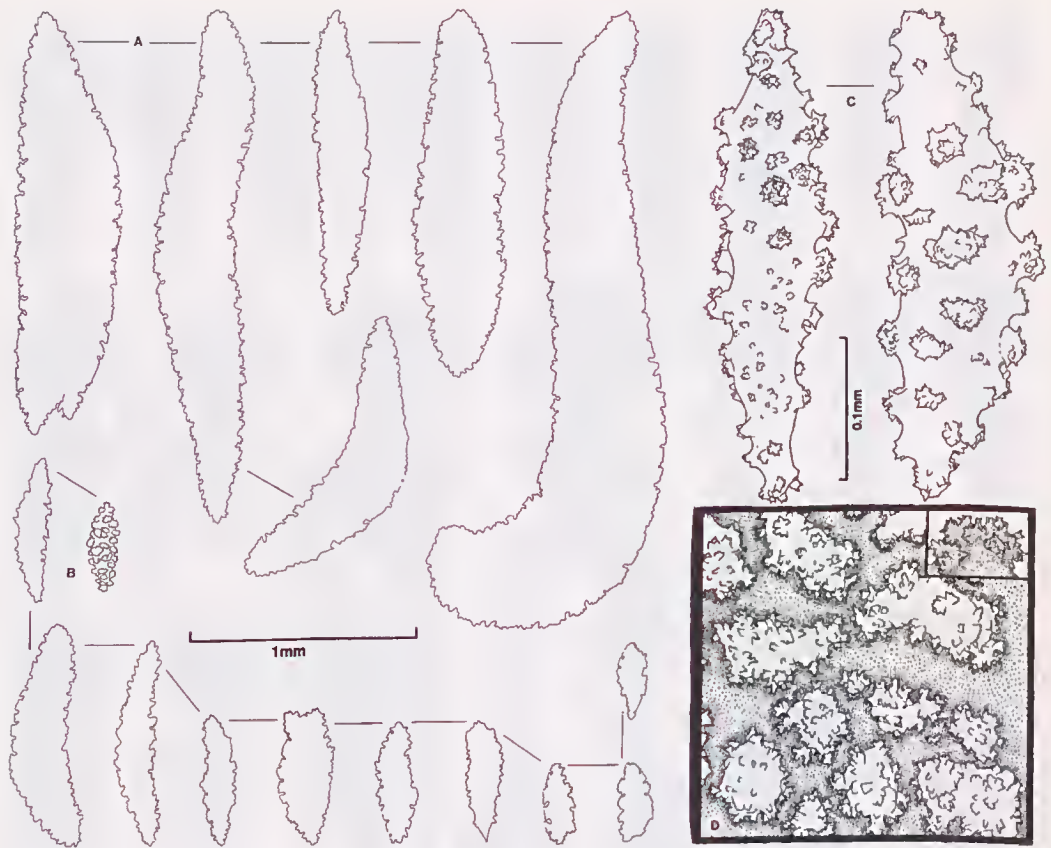


Fig. 48. *Simularia gaveshaniae*, holotype, sclerites from the interior of the base. D, detail of warting.

lobes of *S. maxima* do not have complex warts. Verseveldt states that the clubs of the lobe and the stalk surface layers are the same, which is not the case in *S. gaveshaniae*. There are no plump sclerites in the interior of the stalk of *S. maxima* or forked spindles in the interior of the lobes. Also, chemical oxidation of compounds in *S. maxima* invariably turn it dark grey to black after collection, whereas *S. gaveshaniae* is pale yellow. It is unlikely that *S. corpulenta* Li, 1982, is the same as *S. gaveshaniae*, as the colony has very plump lobes, and the west South China Sea is geographically far removed from the west coast of India. Nevertheless, since Li only figured 4 sclerites, only one of which is a club, it is not possible to make an accurate comparison using his description.

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